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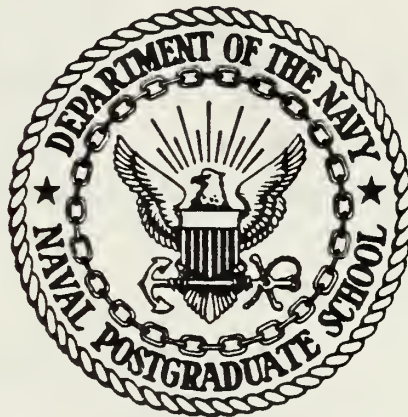
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NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

THE ENFORCER AIRCRAFT PROGRAM: A LOWER-COST
ALTERNATIVE WEAPON SYSTEM

by

Robert P. Holt and Robert D. Dolan

March 1984

Thesis Advisor:

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high/low mix acquisition strategy. The research analyzes the progress, to date, of the Enforcer as a system moving through the stages of the defense systems acquisition process. Emphasis is placed on the differing roles of the Enforcer's participants in that process. There is a detailed critical examination of an Air Force Enforcer cost effectiveness analysis and of the models used in that analysis. Conclusions and recommendations arising from the study are included, especially as they relate to the expected defense acquisition environment in the latter half of the eighties.

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**The Enforcer Aircraft Program: A Lower-Cost
Alternative Weapon System**

by

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Submitted in partial fulfillment of the
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I. INTRODUCTION

A. OVERVIEW AND THESIS ORGANIZATION

This research introduces the Enforcer close air support weapon system and analyzes its progress within the framework of the Department of Defense (DOD) major systems acquisition process. The Enforcer was first proposed in 1971 as a low cost alternative system to complement existing or proposed aircraft designed to meet then current and projected close air support requirements.

The focus of this research is on the unusual nature of the Enforcer program's advocacy both within and outside of the DOD, and on the cost effectiveness analysis conducted by the U. S. Air Force. This program is of interest to students of the acquisition process because it has followed a path best described as parallel to, rather than strictly within, the formal steps outlined in procurement regulations.

In the remainder of this chapter we examine the economic and political environment in the United States during the Enforcer's equivalent of a concept formulation stage. We also briefly outline the formal, nominal acquisition process in effect during 1977. Chapter II summarizes the relative positions of key participants in a quality versus quantity debate which is mirrored by the Enforcer program, and addresses the probable rationale for those positions. Chapter III examines tactical aircraft procurement cost trends in the 1960's and the pressures on DOD to reverse these trends. The DOD and Congressional responses, including the high/low mix concept, are examined. Chapter IV describes the Enforcer as a low cost alternative weapon system and reviews its initial introduction to the military services.

Its advocacy bases in Congress and in the private sector are presented, as is the initial military services' response. Chapter V defines the close air support mission in an operational requirement context. Existing military services' programs in close air support are discussed. Chapter VI describes congressional efforts to encourage military services' sponsorship of Enforcer, reaction to those efforts, and the continuing involvement of Enforcer's private sector sponsors. Legal questions raised by DOD concerning Enforcer's status are introduced. Chapter VII describes modeling assumptions for tactical aircraft acquisition decisions and examines the Air Force sponsored computer analysis of Enforcer cost effectiveness. Chapter VIII briefly reviews the Enforcer program history subsequent to the Air Force analysis and outlines the flight test program currently underway. Chapter IX provides summary remarks and recommendations for acquisition managers which are keyed to the expected defense acquisition environment in the 1984-1989 time frame.

B. WEAPON SYSTEM COST ESCALATION IN THE SIXTIES

Following a decade of substantial buildup of U. S. strategic forces (missiles, submarines and aircraft), attention shifted during the 1960's to the general purpose forces. As ballistic missile procurement dropped off early in the decade, a larger share of the DOD investment budget was devoted to conventional force modernization. Real spending in the defense sector increased dramatically during the latter half of the decade as the Viet Nam war added to the modernization program's requirements for hardware, maintenance and support.

Several trends in the economy during the late 1960's combined to severely constrain the funds available for

defense investment. Inflation was trending upward at rates considerably higher than those contained in budget assumptions. Anti-war sentiment became sufficient to influence defense appropriations in the Congress. Domestic spending requirements, many of them for programs initiated during President Johnson's War on Poverty, were competing for a larger share of the overall budget. Finally, American industry was developing increasingly complex and relatively costly new weapon systems to replace some of the aging pre-Viet Nam era general purpose forces.

This last development, the trend toward more complex, higher technology solutions to defense requirements, sparked a debate among industry, congressional and DOD participants in the acquisition process. That debate continues today and is no closer to resolution than when it began. The issue itself is as complex as some of the weapon systems over which the debate centers. The basic problem which underlies the issue has existed since the first defense appropriation was enacted: how to allocate scarce resources among competing claimants. In its simplest sense, the issue was one of quality versus quantity in weapon systems. The debate participants ranged from those for whom quality, technological complexity and combat effectiveness were synonymous, to those who measured combat effectiveness solely on the basis of numbers of systems available for use. Each participant faced the same budgetary constraints, and most supported positions well inside the two extremes noted above, but there was a wide range of defensible positions in that middle ground.

Congress and the military services were the key opposing debaters, while the defense industries tended to shift their loyalties around as resource levels changed. The Executive Branch involved itself mostly in the highly visible "big ticket" weapon systems, while the Office of the Secretary of

Defense (OSD) and the Government Accounting Office (GAO) occasionally joined in as key participants. The roles of each of the above participants are central to the remaining chapters, as is the role of the Enforcer in the debate. The Enforcer program mirrors the continuing controversy and is one of many pawns in the debate itself.

All of the participants agreed that data showed a dangerous pattern of escalation emerging by 1970: new system unit procurement cost increases consistently exceeded real increases in defense outlays. This pattern was particularly evident in tactical aircraft procurement, where the data tend to support the position that high technology and relative complexity go hand in hand with high program and unit costs. [Ref. 1] The Enforcer program was only one of many proposed solutions to the squeeze between resources and requirements in tactical air warfare. In the following chapter some of the data are presented. The very different approaches to the unit cost squeeze taken by Congress and the military services are examined.

C. THE FORMAL ACQUISITION PROCESS

Although the Enforcer story is one of deviation from the formalized, nominal major systems acquisition process, it is appropriate here to outline that process, or collection of processes, to which the military services must adhere. The governing acquisition regulations are constantly changing, therefore the below outline describes three parallel processes in effect in late 1977, during the time when Air Force resistance to Enforcer test flights was at a peak.

The first major systems acquisition process was implemented by Office of Management and Budget Circular A-109 and by DOD Directives 5000.1 and 5000.2. It was characterized by the identification of a mission need by the military

services, a need defined and documented by mission analyses performed within the services' own staffs. The Required Operational Capability (ROC, formerly the Operational Requirement, or OR) was the service document which formally identified the need and the operational capabilities needed to meet that need. In the case of major systems acquisitions (such as a new close air support aircraft) the Office of the Secretary of Defense became involved. SECDEF approval for such systems was stated in the form of a milestone 0, which directed the sponsoring service to begin exploring alternate concepts to satisfy the need. SECDEF approval was also needed at milestone I - demonstration-validation, milestone II - full-scale engineering development, and at milestone III - production and deployment. Each of these decision points was supported by documenting the program in considerable detail in Decision Coordinating Papers (DCPs) and through formal review in the Defense Systems Acquisition Review Council (DSARC I, II, and III). At each milestone review the SECDEF was in effect reaffirming the need as the program was allowed to proceed into the next phase.

The second process was the Joint Strategic Planning System (JSPS) through which the Joint Chiefs of Staff provided planning advice to the president and to SECDEF. An important element of this process was the Joint Strategic Objectives Plan (JSOP). Volume II of this annually updated document tabulated the forces needed to execute mid-range U.S. military strategy.

The third process was the Planning, Programming, and Budgeting System (PPBS), a kind of "umbrella" of rules which guided the entire process and tied it to the congressional budget cycle. Its key requirements included SECDEF issuance of his Defense Guidance after reviewing JSOP I and issuance of the Planning and Programming Guidance (PPG) after reviewing the JSOP II. The PPG tied mission needs to

programs and was a formalized acknowledgement of the "legitimacy" of an approved major program as well as a guidance document with budgetary constraints recognized. The services responded to the PPG with their Program Objective Memoranda (POM) which were formally reviewed by SECDEF. POM approval was documented by SECDEF Program Decision Memoranda which, with amendments and after a reclama period, became the vehicles with which the services "priced" out their final POM packages for submission to OSD. At the OSD level there was further review with other agencies and personnel from the Office of Management and Budget leading to the final defense budget submission to the president.

The process described above was complex and filled with checks and balances. As the services viewed it, it was a process that did not permit them to unilaterally bring a new major system into the inventory. With many refinements and some major streamlining of phases which proved to be time-consuming and cumbersome, it is the system in effect today at DOD.

II. THE QUALITY V. QUANTITY DEBATE

A. THE COST EFFECTIVENESS ISSUE

In Chapter I we noted that the issue in the quality versus quantity debate was prompted by the combination of scarce resources for defense and rising unit costs of procurement. When compared with other classes of weapon systems, tactical aircraft unit costs were rising at a faster rate and program managers for these forces felt more of the squeeze than did their counterparts for other forces. The Navy F-14 Tomcat fighter in 1973 was projected to cost 190 times as much as its closest World War II kin, the F-4U Corsair. [Ref. 2]. Smaller, but still very large, multipliers are generated for other new tactical aircraft in production or proposed during the late 1960's when they are compared with their WW II counterparts. A new nuclear-powered aircraft carrier, however, was only eighteen times as expensive as its Essex class counterpart, although this distinction seems lost in the shadow of its huge billion dollar absolute cost. [Ref. 3]

Multipliers aside, all program managers were competing for scarce resources, and one of their primary tasks was to demonstrate greater cost effectiveness of certain forces over others and between competing weapon systems within the same forces. For tactical aircraft program managers, the task was even more difficult than for other program managers. The unit cost increases mandated either a larger share of the general purpose forces appropriations or order-of-magnitude increases in combat capability per unit if offensive capability were to be maintained with existing, approved systems.

The question of relative cost effectiveness (in a combat capability context) among different general purpose forces is clearly a part of the debate, but it is not the principal focus of this paper. As the focus narrows to cost effectiveness assessments among proposed alternative tactical aircraft, it is important to remember that a larger debate exists which might propose entirely different forces. Each level of debate is as complex as the next, each is sensitive to the entire range of influences that divide the debaters into opposing camps. For example, while opposing participants debate the merits of alternative close air support systems, programmers on the next higher level might be proposing substitution of some close air support forces with alternative forces such as unconventional warfare units capable of sabotage. Both levels of management might use the same rationale for their recommendations: maximum combat effectiveness from a constrained resource base. Each level attempts to specify optimal weapon system attributes by viewing that system, or combination of systems, as a force structure poised against some threatening force. The criterion of choice is the maximum total capability within a budget constraint, a measure as elusive as the range of assumptions and scenarios which must be selected to structure the threat. This process of choosing was critical to the results of the Air Force cost effectiveness evaluation of Enforcer and is examined in later Chapters.

Superimposed on all of the rational analysis that is associated with cost effectiveness studies is the problem of service rivalries, ingrained and instinctive "turf" protection that greatly hinders unbiased analysis of multi-service weapon system applications. In the Enforcer case the deferral role played by the Army, (discussed in Chapters V and IX), may have influenced the prioritization of close air support scenarios by the Air Force.

The authors recall hundreds of instances in their careers in which suggestions, proposals, or changes were offered, by another service, to a mission area or system considered exclusively "Navy". Many such overtures would be rejected at the outset simply because of the "turf" violation. These rivalries have, over the years, defied the best efforts of Congress, the Secretary of Defense, and the Joint Chiefs of Staff to eliminate them from the planning and programming process. Another dimension of this problem is the inertia encountered when two or more services are directed to analyze a multi-mission/multi-service concept by higher authority. Such was the case with the TFX program in the 1960's, an unsuccessful attempt by Defense Secretary Robert McNamara to develop a common Navy/Air Force tactical fighter and attack aircraft.

B. CONGRESSIONAL POSITION IN THE DEBATE

Congress, particularly through the influence of several powerful members of the Armed Services Committees, usually advocated the high quantity/lower cost weapon systems in those limited cases where there were options available. Among the early indications that the Congress would take this stand, which was in opposition to the services' stand, were a series of General Accounting Office (GAO) reports beginning in the mid-1960's. Each of four reports advanced the theme of the previous, that the trend in DOD toward low quantity procurements of highly sophisticated and costly weapons was not affordable up front and was not providing the predicted returns on investment. This acquisition trend was producing its most disappointing results in tactical aircraft procurements and is examined in Chapter III. The last two GAO reports, Impediments to Reducing the Costs of Weapon Systems (1979) and Implications of Highly

Sophisticated Weapon Systems on Military Capabilities (1980)
both closed with the same, often repeated recommendation to
Congress: [Ref. 4]

...the Congress should carefully examine lower cost alternative programs before approving new weapons systems. In particular it should examine with senior military officials the pros and cons of larger quantities of alternative weapon systems versus smaller numbers of highly sophisticated and expensive systems.

From a historical perspective, Enforcer's reception on Capitol Hill (Chapter IV) was one of the earliest indications of a new emphasis on trading complexity and sophistication - usually synonymous with high cost - for simplicity and quantity. Other more familiar efforts to curb rising unit costs in tactical aircraft followed during the 1970's. Among these were the A-10, F-16 and F-18 programs which were at least begun in good faith as programs offering more "bang for the buck".

C. MILITARY SERVICE POSITIONS IN THE DEBATE

The services had always argued that in an atmosphere of resource constraints the necessary emphasis had to be on smaller numbers of highly sophisticated, high performance systems capable of countering multiple threats wherever possible. Planning and programming directives in the 1960's were sufficiently flexible to allow acquisition managers the freedom to stretch this emphasis to its limits: high technology became synonymous with combat capability and the cost effectiveness exercises tended to be self-defeating. Decision makers found themselves selecting new weapon systems from among alternatives that were all state-of-the-art, all multi-purpose/multi-mission, all very expensive, and all likely to be procured in smaller-than-desired quantities. There were certainly mission areas such

as electronic warfare for which lower cost alternative systems were non-existent. The problem was that the process of transforming any threats into operational requirements and then of matching programs to those requirements by its very nature accommodated the emphasis on highly sophisticated alternatives. There was considerable autonomy within the services with respect to these transformations. Stated differently, there was no safeguard against tailoring an operational requirement to an existing or proposed (and favored) system. Chapters V and VII include discussions of this process as it related to the Enforcer evaluation.

There was an additional flaw in the military service and industry proposals of state-of-the-art systems. These new systems were very capable of successfully countering threats, even multiple threats, but projections of life cycle operating and support (O & S) costs were usually underestimated. There was simply no data available to use for accurate projections of costs since the technology jumps between new systems and those they replaced were in several orders of magnitude. The pace of technological advances outstripped even the most ambitious modernization plans, and the reaction among the services was to narrow the gap with state-of-the-art (technologically risky) systems. The acquisition strategy had become, out of perceived necessity, one of maximizing combat capability for the long term, because the systems had to last so long before anticipated replacement. For the military, especially the Navy and Air Force, combat capability was epitomized in the big ticket systems such as the F-14 and F-15.

The services, of course, did not operate with total autonomy. The GAO reports mentioned above contained recommendations for DOD as well as for Congress concerning control of runaway costs. For the time period addressed in this paper, however, the majority position within the

services in the quality versus quantity debate favored higher quality in lower quantities. Chapter III presents the evidence of this, as well as evidence that the pendulum is swinging, albeit slowly, toward more and more consideration of the congressional point of view. Even today, however, with volumes of data on disappointing performance and proof of grossly underestimated operating and support costs and overestimated budget projections it can be argued that the services still favor the highest technology options.

The Defense Department's own Defense Science Board seemed to predict the hurdles ahead for the debate in a 1973 study which is still applicable today. [Ref. 5]. It stated that the drive for performance at all costs was a cultural problem, that the tendency to bias a decision in favor of a high performance option was present in all levels of the acquisition process: operational requirements, technical approach, system program office practices and staff biases. It further stated that individual values had to be changed, and incentives established to promote individual awareness that the tendency toward high performance is not the only way to go.

The key to the remaining chapters of this paper is the phrase "not the only way to go". This thesis will not attempt to disprove the service position in the debate, but it will examine the difficulties encountered when an equally defensible case is occasionally presented for a lower cost alternative. The Enforcer may or may not have been an equally defensible alternative system, but the Science Board's observations noted above can be seen at each level of scrutiny it received in the Air Force analysis. We will not go so far as to suggest that the decision might have been different had the bias been removed because the evidence suggests otherwise, but Enforcer was not scrutinized under the same ground rules as other more sophisticated systems under consideration at the time.

To summarize the positions of the two key participants in the debate: Congress, closer to the constituency providing the resources with their taxes, felt more pressure to "wind down" from the high defense spending levels during the Viet Nam war, and can observe the costs and benefits of various levels of sophistication with considerably more detachment than the services and with analytical help from GAO, a relatively independent source. Analytical assistance to military programmers is frequently provided by their own staff analysts. Congress was naturally more suspicious of DOD's optimistic resource projections and tempers its projections with a historical perspective. It favors increasing general purpose force levels with larger quantities of less costly, less capable weapons. The military services, on the other hand, start their preliminary programming with an objective of long term combat effectiveness which translates to state-of-the-art technology and multi-mission capabilities. They are concerned with delaying the inevitable obsolescence, a concern not necessarily compatible with lower cost "throwaway" concepts of proven, somewhat older technology. Unfortunately this is the costliest and riskiest path toward self-defense and security, and it sometimes tolerates "projecting" or hypothesizing threats and tailoring requirements to favored systems. There are honorable men and women on both sides of the debate, acting in good faith for what they perceive to be the best interests of the country.

Both sides, in fact, may be partly right. If, in considering the wide range of possible future threats, the decision maker rationally places the highest priority on a "worst case" scenario, then most analyses will favor the highest technology system. In this case, the weapon system becomes thought of more as a platform for delivering a specific weapon than as part of a force structure. When the

"worst case" scenario is determined to have a lower priority than others, perhaps due to a very low probability of occurrence, the most cost effective choice may be a combination of the two, something the Navy called the high/low mix acquisition strategy.

III. PRESSURE FOR CHANGE

A. TACTICAL AIRCRAFT COST TRENDS

In Chapter I it was suggested that there was agreement among defense systems acquisition managers and in Congress that a clear and dangerous pattern of escalation in costs had emerged by 1970. This trend was most evident in tactical aircraft procurements. U.S. tactical aircraft are the most complex in the world, this complexity is associated with high unit costs and lower quantities, and it seems natural that the focus of much congressional attention in the early 1970's was upon this highly capital-intensive segment of our defenses. Cost escalation was enhanced by higher than expected inflation rates, sharply higher operating costs after the crude oil price increases in 1974, and higher manpower and training costs in the All-Volunteer Force. Taken together, however, these accounted for only one-third of the unit cost increases. The culprit was the hardware itself, the high cost of multi-mission capability and complexity. Figures 3.1 and 3.2 illustrate a critical factor in the trend toward lower procurement totals and higher unit costs.

The direction in which the trend lines are headed is the reason for use of the term "dangerous" pattern. It is clear that continued phased modernization of our tactical air forces while maintaining current overall capability is impossible given the concurrent requirements in other forces and even the most optimistic budget projections. This acquisition policy "forces" DOD managers into the tactical aircraft replacement strategy they embrace: maximum technical substitution. One of the most frequently recalled

SOURCE: White, W.D., U.S. Tactical Air Power, p. 48

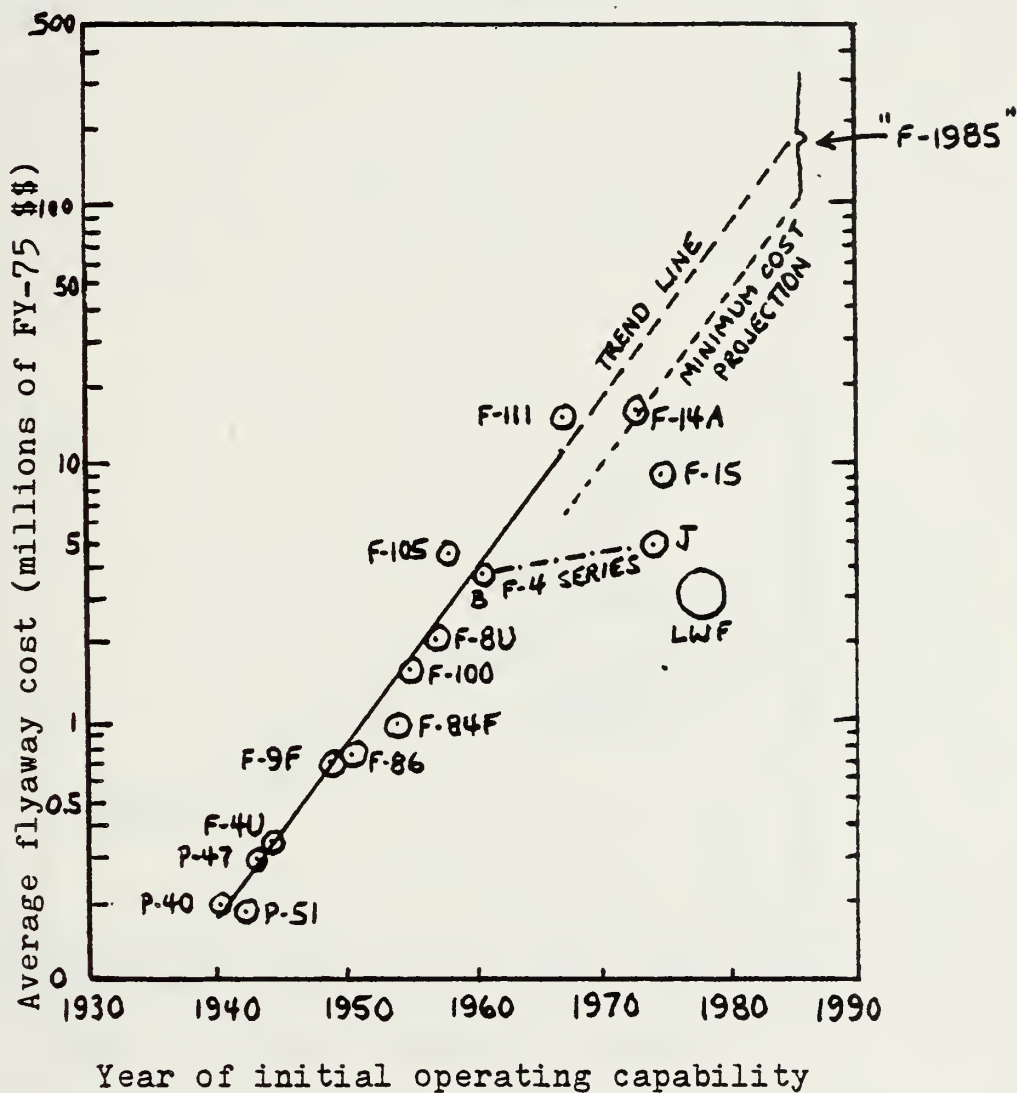


Figure 3.1 HISTORICAL UNIT COST ESCALATIONS - FIGHTERS.

SOURCE: White, W.D., U.S. Tactical Air Power, p. 57

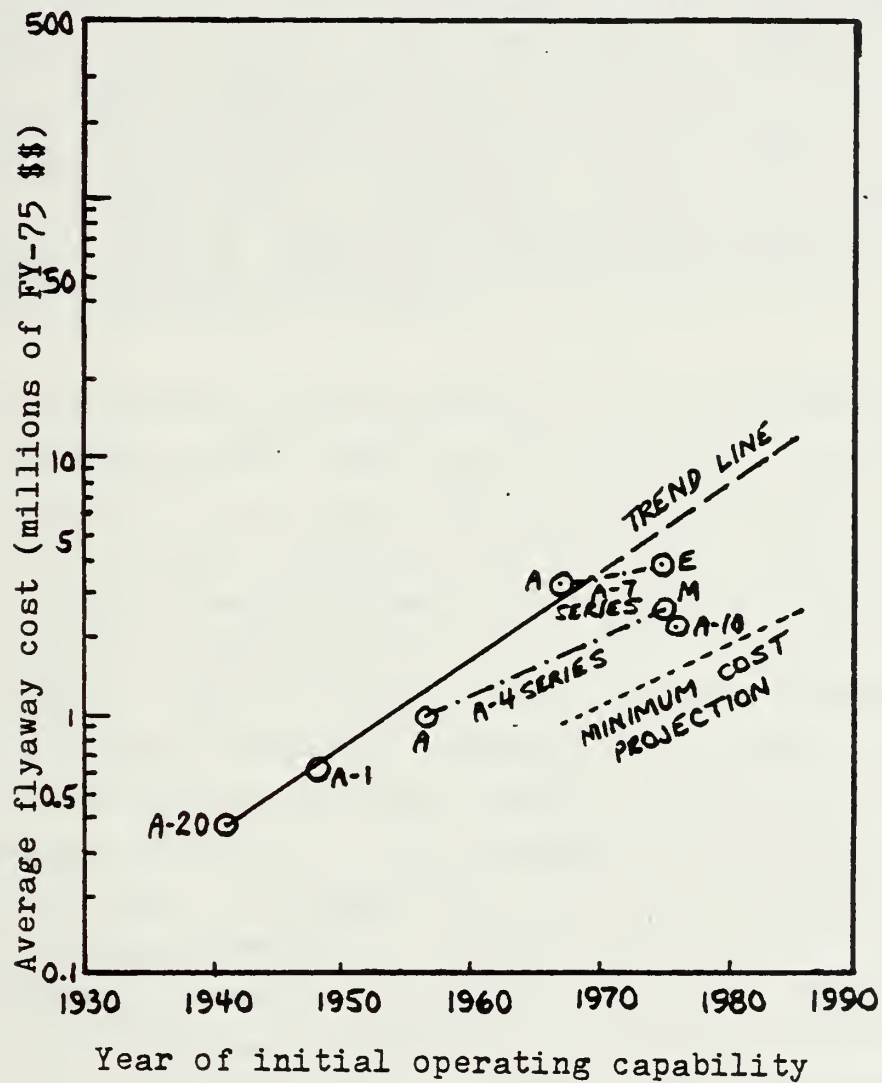


Figure 3.2 HISTORICAL UNIT COST ESCALATIONS - ATTACK.

arguments supporting spiraling costs of new combat aircraft is that they are produced at uneconomical rates, but the author of a Brookings Institution study disagrees: [Ref. 6]

The argument that modern fighters seem more costly than they really are because of the penalties imposed by uneconomic production runs therefore confuses cause and effect. It is not so much that modern aircraft are so costly because fewer are built as it is that fewer are built because modern aircraft are so costly. Through the constraint of total costs, production of fewer aircraft becomes the pragmatic corollary to expensive aircraft designs. The effects of lower production must be viewed as a secondary, dependent factor in the cost trend... This leaves increasing technical complexity, manifest both in the growing size of the aircraft and in the ever-greater precision and sophistication of their component parts, as the principal explanation for the upward trend in unit costs.

As indicated in the previous Chapter, pressure to reduce these mounting costs was felt in the agency closest to the resources and to the constituency providing those resources, not in DOD where the services considered it their prerogative to start planning from an optimistic, unrealistic base and then to proceed toward the real budgetary guidance. This mindset contained the seeds of its own destruction, and widely-followed columnists referred to the first submissions of the DOD budget as "wish lists". There were, in fact, substantial pressures on DOD managers by 1974, but they were not sufficient to prompt any change in strategy. Indeed, despite annual assurances by the service chiefs that their recommended new systems were the most cost effective solutions to legitimate threats, a military service rarely initiated development of a lower cost alternative to a proposed new system. The procurement process itself seemed incapable of any substantial change from what had become business as usual - runaway costs, smaller-than-planned procurements, higher unit costs and increasing sophistication. It remained for the Congress to take the initiative, and this is where a program such as the Enforcer could find a support base.

B. THE HIGH/LOW MIX CONCEPT DEFINED

Former Chief of Naval Operations Elmo Zumwalt takes personal credit for first using the expression high/low mix to refer to his "Project 60", a major reprogramming effort conducted during his first 60 days as CNO, although he had advanced the concept under a different label many years earlier as a staff officer in Washington. In the early Zumwalt days it was a concept limited to the force mix of combatant ships but by 1976 there were frequent references to it in congressional hearings and in the aerospace trade press on the subject of tactical aircraft force mixes. DOD references to it for other than Navy ship procurements were almost nonexistent, the acquisition process itself had difficulty accommodating any tactical air strategy that did not embrace the principle of 100% maximum technical substitution. [Ref. 7]

The high/low mix concept is a simple one in theory: whenever it is most cost effective to do so and whenever appropriate candidates are available, acquisition managers should select the best mix of lower cost, less capable systems and higher cost, more sophisticated systems to satisfy an operational requirement or requirements. The difficulties lie in the meaning of the term cost effective as it relates to tactical aircraft. This is itself a major task, and as William White points out in his study, the process may eliminate a legitimate lower cost alternative from further consideration: [Ref. 8].

Although the potential for reducing battle casualties may be the strongest argument for continuing the traditional U.S. philosophy of pressing the limits of technology in weapons development and procurement, the usual test in deciding whether a specific new system should be procured is that of dollars-and-cents cost effectiveness. Does the new system offer enough extra capability to justify its (typically) greater cost? Even with the simplest weapon systems, a precise answer to this straightforward question can prove tantalizingly elusive. With complex systems such as tactical

warplanes, concrete conclusions about economic justification are seldom if ever attainable. In this atmosphere of uncertainty the traditional practice of the United States in equipping its military forces seems to award the benefit of the doubt to innovation and the new weapon... Because of the singular difficulty the analyst encounters in trying to measure military 'output' (or even finding a quantifiable definition of what it is that U.S. armed forces produce), it cannot be demonstrated conclusively that this approach has been economic, let alone optimal. Obviously it has not led to lower defense budgets or fewer men in uniform.

What appears to be a recipe for decision makers is instead a very complicated, difficult process of determining first what the requirement is and should be, then fashioning that requirement into a request for response from industry, and finally choosing the "best mix" from among candidates which provides the most cost effective use of of the resources made available to defense. At each step in the process there are pitfalls; bias and favoritism can enter the process, and seriously flawed assumptions can skew the data and resulting analysis. It is extraordinary that many excellent decisions do, in fact, result from the process. Chapter VII examines that process, although a somewhat modified version, in the Enforcer/A-10 analysis. Whether or not its sponsors ever intended it to be considered in a high/low mix context, the fact is that the "usual test" was applied and the benefit of the doubt was awarded to the "new" weapon, but not necessarily to the most innovative.

IV. ENFORCER, A LOW COST ALTERNATIVE

A. EARLY CONCEPT FORMULATION AND SPONSORSHIP

Mr. David B. Lindsay, Jr. is a former newspaper owner-publisher from Sarasota, Florida. He has been flying since 1941 and is active in the restoration and flying of high performance World War II aircraft, especially the P-51 Mustang. During 1957 his company, Cavalier Aircraft, began rebuilding and modernizing surplus Mustangs for the civilian market. Some friendly foreign nations expressed an interest and in the early 1960's Cavalier Aircraft was delivering Mustang conversions to the Air Force for sale under the Military Assistance Program as trainers and counterinsurgency aircraft. This was a very modest program, never operating in the black for Cavalier. Mr. Lindsay, a student of tactical air warfare, saw a great potential in the Mustang concept as a close air support system. Two things encouraged Mr. Lindsay to take his concept beyond a purely academic exercise. The first was a requirement within DOD in 1969 for a new close air support (c.a.s.) system to be deployed in the mid-1970's. The requirement was driven by a worldwide threat but with an emphasis on the perceived Soviet/Warsaw Pact threat in central Europe. The second was a speech delivered earlier by then Deputy Secretary of Defense Packard encouraging private entrepreneurs to come forward with innovative concepts and prototype weapon systems. His verbal call for offers was backed by language in the Armed Services Procurement Regulations (A.S.P.R.) which made provisions for higher profitability potential and protection from competition for developers of weapon systems funded entirely within the private sector. These A.S.P.R. incentives are discussed in several of the following chapters.

Mr. Lindsay designed and built a substantially modified Cavalier Mustang around the P-51 airframe called the Enforcer. In 1970 he demonstrated it to interested civilian and military managers at various locations on the east coast. With the lessons learned from this 100 flight-hour effort he returned to the drawing boards and designed a newer Enforcer around a different, much-improved engine. This version caught the attention of Piper Aircraft, and it bought the entire project including rights, patents, drawings, prototype and spare parts from Mr. Lindsay in 1970. Mr. Lindsay was retained without compensation as a consultant to Piper. The terms involved a small down payment and a modest profit-sharing agreement if and when production commenced. As the transfer of hardware and data from Cavalier to Piper began, Piper accepted an Air Force Request for Proposal (RFP). It was an invitation for participation in PAVE COIN, an unfunded demonstration to the Air Force of candidates for a new counterinsurgency aircraft. A parallel effort to identify candidates for a new light utility aircraft was included. The winner of the counterinsurgency competition could also be expected to replace the aging Douglas A-1 Skyraider in the Vietnamization program. [Ref. 9]

Piper, with Mr. Lindsay as an advisor, confidently entered the competition. They relied on the good faith of the Air Force and on the language of the RFP which implied that the winner of the PAVE COIN competition would be awarded a contract for a minimum of four hundred aircraft. Piper estimated it could build four hundred fully equipped Enforcers for a 1971 flyaway cost of \$610,000 each. The Enforcer was a hands-down winner, no other counterinsurgency entrants could meet all of the minimum requirements, yet no procurement contract was ever awarded. Each of the industry participants in PAVE COIN's counterinsurgency aircraft

competition lost 100% of its investment. With the exception of Enforcer, all entrants were production aircraft entered at little risk to their manufacturers. Piper estimated its loss at a million dollars.

In 1969, two years prior to PAVE COIN, Republic-Fairchild Corporation's A-10 prototype won a flyoff against Northrop's prototype, designated the A-9, and was awarded a contract for full scale development of the next Air Force primary mission c.a.s. aircraft. The A-10, in various proposed production schemes, was moderately priced. 1975 SAR data indicates a current proposed production run of 733 aircraft at a unit flyaway cost of \$2.23 million. It was a relatively sophisticated system capable of day or night close air support against a NATO worst-case scenario, a full scale heavy tank assault which is discussed in the next chapter.. The A-10 was optimized for that worst-case scenario, a scenario whose associated operational requirement was written by the ultimate end-user of the aircraft, the Air Force. There are two important points to consider at this stage in Enforcer's story. The first is that at the conclusion of PAVE CCIN in 1971 with the A-10 program early in its full scale development phase, The Enforcer was not being considered by its private sector sponsors as a solution to any existing specific operational requirement(s). They viewed it as an innovative aircraft capable of effectively performing some of the mission elements common to the DOD definition of close air support at a relatively low cost. The second is that the A-10 program, when compared to other tactical or strategic aircraft programs in the defense budget at the time (F-14, C-5), was itself a relatively low cost, high quantity system, although much more sophisticated than the various aircraft then performing its mission. Compared with Enforcer, however, it belonged squarely on the high side of any conceivable "mix" of the two, if one

accepts the concept definition of high/low mix presented in Chapter III.

Piper aircraft, assisted by Mr. Lindsay, saw an opportunity to recoup its PAVE COIN loss and to keep the Enforcer program moving ahead. It proposed Enforcer not as a substitute or direct alternative to the A-10, but as a complement, a lower cost alternative system to be added to the c.a.s. inventory. [Ref. 10]. Aside from the fact that this implied an additional increment to the c.a.s. mission area budget line, it was, in fact, being proposed as the low end in a high/low mix.

B. INITIAL ENFORCER CONFIGURATION

The uniqueness of the Enforcer presents a formidable task for an analyst trying to compare it with existing or proposed aircraft in the DOD inventory. It is easiest to initially consider it in total isolation. The Enforcer is 34.2 feet long with a wing span of 41.3 feet and a wing area of 257 sq. feet. Its maximum takeoff weight is 14,000lb., normal landing weight is 12,340 lb. and it has a maximum payload of 5,680 lb. Fuel capacity is 424 gallons including two 120 gallon tip tanks. Its design speed maximum is 350 knots with the current engine configuration, an Avco Lycoming T55-L-9A rated at 2,445 shaft horsepower turning an Aero Products 11.5 foot diameter four-blade propellor. Combat radius is approximately 400 nautical miles. It was optimized for day, fair weather close support operations against a lightly mechanized enemy infantry assault. This mission element was only an incidental part of the then current Air Force operational requirement for close support. Again, Chapter V discusses the entire requirement and the threats generating it. The following Piper Aircraft Company list of Enforcer's early configuration and characteristics

is useful for identifying the void its manufacturer hoped it would fill:

- Uniquely fills operational spectrum between armed helicopter and pure jet. More armor per pound of airframe weight than any aircraft in the world. Uncomplicated armament controls, within peripheral view of the pilot..a Lindsay patent.

- Smallest silhouette, lowest infrared signature, lowest noise level, fastest acceleration and highest survivability of any attack aircraft.

- Engine hot section forward of all flammable liquids.

- Lycoming T-55 same basic engine as Army's CH-47 Chinook. Army holding as excess more than 300 of these engines removed from Chinooks for replacement with larger engine.

- Large worldwide market already identified by DOD.

- Six 50 caliber (12.7 mm) machine guns with 2000 rounds of ammunition, internally in wings. Optionally, two 20 mm 3-barrel GE Gatling guns.

- Ten underwing stations for all standard inventory ordnance, including missiles.

- Wide speed range (78-403 knots) and high maneuverability permit operations under low cloud ceilings, in mountainous areas, and under its own flares at night.

- Performance proven by tests of flying prototype..not theoretically projected

- Ideal tank killer and helicopter escort or helicopter killer.

- Capable of operating from short, unprepared fields in combat zone to obtain common fuel and ammunition from ground units.

- World's only jet turbine powered, propellor-driven, low/high threat close support aircraft.

- Uniquely low fuel consumption conserves critical fuel supplies and gives longer loiter time.

- First U.S. combat aircraft designed, built and privately tested without any government financing. (authors' note: still the first)

- Developed especially for direct fire support of ground troops (close air support, classical definition)

- All-alloy aluminum construction permits low price, quantity buys, and field repair. (authors' note: the armor in critical areas is also field repairable)

- Projected low initial cost, extremely low operations and maintenance time and costs (less than \$150/flying hour) resulting in high in-commission rate

- ferryable world-wide without air-to-air refueling

- Simplicity guarantees ease of pilot and ground crew training, plus effective utilization in all countries.

SOURCE: Piper Aircraft presentation to congressional subcommittees in 1974 and 1975

These were Enforcer's calling cards, but only a few of the above performance characteristics had been demonstrated by prototype flights. With no specific operational requirement (O.R.) for an Enforcer-type aircraft in 1971, it was

clearly handicapped in any attempt to move into the acquisition process. This handicap also enjoyed no offsetting military service sponsorship. Without a constituency of its own it appeared to have little chance for serious consideration at DOD.

C. EARLY CONGRESSIONAL SUPPORT

The only additional source of sponsorship available to Enforcer following PAVE COIN was in Congress. As a privately developed weapon system not involved in formal competition or negotiation at DOD, Enforcer could not capture the attention of even the most cost-conscious managers there. The period 1970-1974 was marked by personal lobbying by Mr. Lindsay who was joined by Mr. Helms, the new president of Piper, early in 1974. They visited contacts at DOD and elicited more sympathy than enthusiasm. The acquisition system provided no incentives whatsoever for formal DOD consideration of this unsolicited new system, regardless of its credentials. Within Congress, however, and particularly in the Senate at this time, the pressures for cost reduction discussed in Chapters II and III were very real. Mr. Lindsay, in particular, was able to begin to generate active interest in the Enforcer in a series of informal hearings at the subcommittee levels. Some personal friendships were involved, but that is an acknowledged and legitimate way of opening doors in Congress and has little bearing on this case. Mr. Lindsay was not a highly paid lobbyist for a major defense contractor, he had a very personal stake in the Enforcer's future and some of the most powerful members of the Senate found this refreshing after hours of contractor testimony on the huge overruns then occurring in major defense programs. The Enforcer weapon system had a legitimacy of its own and could conceivably have been brought to those hearings by someone unknown to the Senators involved.

The early hearings, up to 1974, were no more than a discussion stage. Mr. Lindsay and Mr. Helms sought only to have Enforcer subjected to rigorous testing by one or more of the services. Some informal inquiries were made by a few members of the Senate to various levels at DOD, but they failed to make any progress toward elevating Enforcer's present status as an interesting modest experiment within the private sector. There is a certain sanctity within defense systems acquisitions that is respected even by those with the power to advance or deny resources, a tangible evidence that weapon systems selections are usually best left to those who know the system best, the end users. The real congressional micro-management of the defense procurement arena was concentrated in the myriad problems occurring after the award of a production contract.

By late 1974, however, the country was trying to shake off the effects of a deep recession. Cost overrun "horror stories" in the C-5, F-14, and other acquisition programs were capturing headlines, and the mood in Congress was changing to one of involvement in the earliest stages of a system: alternative concept development and prototype development. For Enforcer, this meant the transition between the discussion stage and the examination stage over at DOD. This transition period is addressed in Chapter VI.

D. INITIAL MILITARY SERVICES RESPONSE

Between the conclusion of the PAVE COIN flights in August 1971 and the more active examination stage in late 1974, exchanges between Congress and the services concerning Enforcer were largely informal. The congressional testimony from the period related to Enforcer indicates that while some powerful senators in the Armed Services Committee were keenly interested in the Enforcer concept, their interest

was mostly in-house. The informal exchanges with senior DOD managers lacked the tone of urgency which characterized later specific taskings and that elusive sanctity mentioned above was not being violated. There are references to three "paper" studies conducted by groups with little or no likelihood of potential roles in any Enforcer acquisition decision. One study was conducted by the Joint Technical Coordinating Group for Air Survivability. It assessed the data on Enforcer's total combat survivability using only written contractor specifications on the aircraft. The other two were engineering studies conducted by the Marine Corps and the Naval Air Systems Command. The Navy/Marine Corps team was the least likely among the services to demonstrate a requirement for any tactical aircraft that was not aircraft carrier-compatible. Both sets of studies served to validate Piper's claims for the aircraft, within the constraints of paper studies. They proved useful later on, during the Air Force analysis aftermath discussed in Chapters VII and VIII. They were not significant factors in the transition between discussion and examination which was prompted more by environmental and economic factors than by anything else. By mid-1974 the Air Force had not formally commented on the Enforcer.

V. THE CLOSE AIR SUPPORT MISSION

A. THE DEFINITION VERSUS THE OPERATIONAL REQUIREMENT

The Joint Chiefs of Staff Dictionary contains the widely accepted definition of close air support: [Ref. 11].

Air attacks against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces.

DCD describes close air support operations as "call fire" in response to direct requests from ground units or through forward air controllers (FACs). As these same sources may be calling simultaneously for artillery, good liaison procedures between controllers and the close air support aircraft are essential. Aircraft capable of heavy ordnance loads and low level operations must be able to scramble quickly from nearby bases or be able to loiter in the area on call. The zone of operations tends to be no deeper than five kilometers from friendly forces, hence accuracy of weapons delivery is extremely important. While large, mobile surface-to-air missiles (SAMs) are possible in this zone, they are less a threat than AAA and hand-held, short-range SAMs. Fighter escort is usually not assigned, though there may be general front coverage against raiding aircraft.

Definitions serve a useful purpose, but they necessarily fall short of providing planners and programmers with an all-encompassing set of specific threats against which some effective weapon system might be designed. Their purpose is to define those characteristics of a mission area that are universal. Close Air support in the 1973 Yom Kippur War was

not the same as close air support in North Viet Nam or in Korea. Each scenario was marked by distinctions which were best countered by aircraft specifically tailored for it. The hypothetical optimum tailoring might span a range from simply different shades of camouflage paint on the same aircraft to a totally different weapon system with different ordnance, power plant, and base of operations. The task of the military systems planner is to combine all possible scenarios on paper and to try to state a required operational capability that counters every possible threat in each scenario.

In Chapter II we referred to this task as a process of transformation, the first step in the chain of events between the realistically assessed threat and the selection of a weapon system to counter it. Considerable flexibility is available to the end users of weapon systems, the military services, when they first set out to write or revise a specific operational requirement (S.O.R.). Within broad and usually optimistic resource constraints, the first cut tends to be an idealized solution which would provide close to 100% assurance of successfully countering the threat(s). This paper exercise of compiling what amounts to a wish list might seem harmless enough, although wasteful of the planner/programmer's time in view of fiscal realities. It has the effect, however, of biasing the overall approach to the problem in favor of the highly sophisticated alternative. There is a tendency to accept the basic premise of the maximum capability (highest technology) idealized solution as the starting point and to reduce its quantity and/or stretch out its proposed production period as budget constraints are applied. In other words, before any lower cost alternatives can be considered the process must first accommodate the widest acceptable range of cost-controlling options in the idealized solution, a methodology that will

favor or prioritize the idealized choice. As discussed in previous chapters, the trend during the 1960's and 1970's was to find an accommodation at some point before consideration of a lower cost alternative was ever reached. For some threats, this methodology may actually provide the best choice possible. The application of constraints to a system the services would prefer to have is a healthy process and still produces a very capable system, although possibly in insufficient quantities or with underfunded support if inappropriate cost reductions were applied.

The importance of the wording of the operational requirement cannot be overemphasized, for it can be weighted to prioritize a threat element that is either of low probability or that can only be countered by a system favored by the writer of the S.O.R. For example, whether or not it can be shown that a "second best" selection decision resulted, the S.O.R. against which the A-10 was selected was tailored to a worst-case scenario for which the A-10 was optimized. Chapter VII examines the consequences of this sort of tailoring in the Air Force sponsored Enforcer cost effectiveness evaluation.

A. EXISTING CLOSE AIR SUPPORT PROGRAMS

A brief review of the variety of aircraft in production or proposed during the 1970's with a primary or secondary close air support mission is appropriate at this point. They range from aircraft which were simple and inexpensive enough to be considered "throwaway" systems relative to some others, to the most costly and complex tactical aircraft ever produced. They involve different military services, different operational requirements, different program sizes and vastly different capabilities. They are presented to remind the reader that when the military services are taken

as an entity, high cost and high technology solutions to the c.a.s. problem were clearly not the only way to go.

The A-4 Skyhawk was phased out of Navy tactical air units by 1976, but it remained in the Marine Corps inventory as a close air support and deep interdiction aircraft. Marines base their A-4 units on land, as near as possible to the fighting forces, but the aircraft are capable of carrier operations. Special purpose Marine airfields using SATS gear (catapult and arresting gear) enable the A-4 to operate out of small unprepared fields. Its proposed replacement in the 1970's was what is now the F/A-18 Hornet, a highly sophisticated dual-role aircraft. It can be readily converted from its fighter configuration to an attack platform capable of both deep interdiction and close air support missions. Carrier-based units will perform in both roles. It can be air refueled for extended-range interdiction missions. The Marine Corps also employed its AV-8A Harriers, introduced early in the 1970's, in a close air support primary mission role. When air refueled it can be used in a secondary role as a deep interdiction weapon and has some self-protection capability if fighter escort coverage is not available. The Harrier trades off range and payload performance for the unique capability to take off and land vertically, in totally unprepared landing areas. Other Navy and Marine aircraft capable of close air support missions are the A-7E Corsair and the A-6E Intruder, earlier versions of which were in the active carrier-based inventory in the 1970's. The A-7 is designated a light attack aircraft and can perform both deep interdiction and close air support missions with self-protection afforded by AIM-9 Sidewinder missiles and a 20 mm GE Gatling internal cannon. It will also be phased out with the introduction of the F/A-18. The A-6 Intruder is a medium attack aircraft in use in both the Navy and the Marine Corps. It is capable of all-weather deep

interdiction and close air support, and carries the largest payload of any Navy or Marine Corps attack aircraft. Both the A-6 and A-7 series aircraft are air refuelable. [Ref. 12]

Although each of the above aircraft have a close air support capability and could conceivably be compared with an Enforcer type aircraft with regard to airborne combat effectiveness, (getting to and from the target, loiter, self-protection, vulnerability, weapons loads, accuracy, etc.), their common characteristic of aircraft carrier compatibility sets them completely apart. Carrier capabilities place substantial additional demands on an airframe that are translated into much higher costs, additional subsystems for enhanced safety, structural improvements which add substantial weight, and an overall additional measure of complexity for all weather operations. The TFX (F-111) experience was a harsh reminder that carrier capabilities cannot be added as an afterthought to an airframe designed primarily for land-based operations. There was, of course, no intention by Enforcer's designer or manufacturer to even suggest that it could be made carrier capable in the future. Since the paper studies in print as of 1974 suggested that there might be a place in the DOD inventory for Enforcer, its lack of carrier capability left only the Army or Air Force as a possible sponsor. The Army, however, had deferred to the Air Force in the fixed-wing close air support mission as a matter of doctrine, a doctrine that was unchallenged in the 1970's.

The Air Force has several aircraft capable of close air support which were in service or proposed during the 1970's. Their multi-purpose (but not carrier capable) A-7D performs both close air support and deep interdiction missions. It is optimized for the latter, with state-of-the-art digital avionics, inertial navigation, and computerized weapons release systems. The F-4 Phantom, primarily an all-weather

interceptor, has a limited c.a.s. capability but its interceptor design characteristics (for supersonic flight) make it less suitable than most for the mission. The A-37B, a variant of their primary jet trainer, was capable of light attack and close proximity air support. The OV-10, a forward air control/light utility aircraft, was only marginally suited for very limited close air support. On the other hand, the A-10, which was in early full scale development in 1974, was a specialized primary mission close air support platform also capable of a limited deep interdiction role. Although much more sophisticated than Enforcer, its speed range and weapons variety were roughly comparable. Chapter VII presents its characteristics in detail. Regardless of the appropriateness, if there were to be a comparison at all between Enforcer and any other aircraft in active service or proposed by 1974, it would have to be with the first pure-jet aircraft designed as a primary mission c.a.s. platform, the A-10. [Ref. 13]

B. PROJECTED CAS ENVIRONMENT

By 1974 the attrition statistics from the Yom Kippur War had been analyzed by planners all over the world. The effectiveness of some of the newer Soviet SAM systems and anti-aircraft batteries caught the attention of analysts, programmers, and, perhaps more significantly, military pilots here and abroad. When the material loss statistics from that brief but intense war were superimposed on the NATO central European scenario the meaning was ominous: NATO forces would have to gain the upper hand over advancing enemy forces on the ground by the fifth day of the invasion or there would not be sufficient general purpose forces remaining in NATO to prevail.

While NATO defense ministers wrestled with the diplomatic efforts associated with mutually balanced force reductions between themselves and the Warsaw Pact, operational commanders, more concerned with the ability to win after a failure of diplomacy, faced some very difficult choices. Appropriate force levels to counter the postulated massive assault capability from the east required nearly unacceptably high buildups of NATO conventional ground and air forces in both quality and quantity. The option to resort to tactical nuclear weapons was a controversial one, a last-resort contingency some of the NATO nations refused to even consider. The debate over whether nuclear weapons have any tactical applicability at all or whether their use would almost immediately trigger the use of strategic weapons will continue long after current generations of general purpose weapons have been retired. What is significant is that despite the worldwide outcry there remained enough pressure on conventional forces' capabilities that by 1974 there were plans for tactical nuclear weapons to become an important part of the defensive force composition, and ultimately to be a part of the offensive arm, on both sides.

The quality versus quantity debate thrives in this NATO Europe scenario. Even the countries willing to host nuclear weapons want their conventional weapons capability to be strong enough to minimize the chance of a last resort employment of the nuclear weapons. The question is how to arrive at that position of strength. The close air support environment in which NATO forces might operate is extremely lethal. It can be used to argue for either an increase of A-10's or for a mix with Enforcer type aircraft. A variety of threats and weather conditions can be predicted, depending on the nature of the enemy's thrust. What is known with certainty, however, is that the enemy has the capability to strike in great numbers with a wide range of

general purpose forces. The following testimony on the subject of c.a.s in NATO Europe illustrates both the seriousness of the threat and the complexity of the range of responses: [Ref. 14].

First, it is clear that the effects of inflation and the increasing sophistication of aircraft weapons systems have made the price of most of the weapons now under consideration for close support cost so many millions of dollars each that it may be impossible to acquire a sufficient number of them to provide the credibility, both to our allies and to our enemies, that only large numbers can assure...Second, it is known that the Soviet Union and the Warsaw Pact nations have four times as many tanks as the United States and its NATO allies, and at least five times our tank production rate. They are also 40 per cent ahead of us in tactical aircraft numbers, which they are producing at double our own rate. In addition, their anti-aircraft defenses are deployed in greater numbers...The first three days of a Pact attack on Europe probably would determine the outcome of a conflict. Many people are deeply disturbed at the apparent reliance of the Pentagon on tactical nuclear weapons, which would seem to result from a paucity of alternatives...Another point on which I believe we can achieve agreement is that the Soviet weaponry which was first revealed in the October 1973 war in the Middle East has caused a drastic reevaluation of the close air support role as to survivability...Today, there is general agreement that pinpoint close air support will have to be performed with standoff weaponry of the fire-and-forget variety, such as missiles or long range guns, or with extremely low level delivery of cluster-bomb weapons.

VI. SEARCH FOR A SPONSOR

A. CONGRESSIONAL PRESSURE

In Chapter IV we stated that environmental and economic factors, not the validation studies, were the catalyst to move the Enforcer initiative from discussion to examination. Those factors (recession, cost overruns, etc.) have been discussed earlier. By the late summer of 1974 a sense of urgency was apparent in those subcommittees which had been patiently listening to the Enforcer testimony. The validation studies all tended to focus on the Air Force as a potential sponsor, and the Air Force was the last to respond to informal congressional prodding with their analysis. During this period the Air Force was mobilizing support for an A-10 production decision in the face of a final hour congressional effort to reconsider the A-7. Pressure from the Texas congressional delegation (A-7's were produced in Dallas by the LTV Corporation) forced a new competitive flyoff which delayed a final production start for the winner, the A-10. With this end run threatening to erase years of dedicated acquisition effort in the A-10 project office, it was not surprising that the close air support program managers considered the Enforcer program's congressional interest to be a low priority. [Ref. 15]

Formal contact with DOD concerning the Enforcer began in July 1974 with a series of letters from various powerful committee members to high level DOD officials. The theme of the correspondence was consistent - the authors believed in the Enforcer concept and urged the recipients to consider a modest test program of the latest Enforcer version under DOD auspices. Coincident with these first letters, the Air Force

initiated its own analysis on the Air Staff and within the Aeronautical Systems Division of their Systems Command. This comprehensive analysis, presented in the next chapter, became an interesting paradox for the Enforcer's supporters in Congress: DOD officials delayed in responding to the early test requests while the Air Force analysis was being completed. This delay annoyed the requesters as indicated in the tone of their followup letters, yet the final responses from DOD cited the analysis results as the reason testing would not be considered.

The following excerpts from the above-mentioned letters mirror the sense of frustration on Capitol Hill. The first, dated July 19th, 1974, was addressed to then Secretary of Defense Schlesinger and was signed by Senate Armed Services Committee members Senators Proxmire, Thurmond, McIntyre, Tower and Jackson: [Ref. 16].

You have recently asked for the cooperation of Congress in holding down defense costs. As members of the Senate, intensely interested not only in the economy but also military effectiveness, we strongly recommend that you personally initiate action to test fly the Enforcer close air support aircraft...It is our belief that the Enforcer promises such an attractive combination of economy and effectiveness that it should not be cast aside by service biases...

After four months without a response, the same senators signed a terse followup dated November 7th: [Ref. 17].

As of this day we have received no reply from you. This raises the question about how seriously the Defense Department considers the declining level/rising costs dilemma...Once again we ask for your reply. Why should this aircraft not be flight tested?

After the results of the Air Force analysis were available, Deputy Secretary of Defense Clements responded to the above two letters with the following reply dated January 3rd, 1975: [Ref. 18].

Dear Mr. Chairman: This responds to your letters recommending that the Department of Defense test fly the Enforcer aircraft. First, let me assure you that we are constantly seeking systems which will provide effective combat capability at reduced cost; our Air Combat Fighter Program is just one such example. The Enforcer proposal has been extensively reviewed against these criteria. These reviews conclusively establish that there is no place for such an aircraft in the Department of Defense...The Air Force has recently completed an extremely thorough review of Enforcer capabilities, combat configurations, development and production requirements and vulnerability. These data have been used as the basis for comprehensive analyses of the aircraft's effectiveness in the type of combat environment described in your letters. These analyses accepted uncritically all the designer's claims for payload and weapons system effectiveness. We believe that this Air Force study clearly establishes that: the Enforcer is not the optimal, and certainly not the only, aircraft of its type; this type of aircraft is not well suited to provide close air support in a tank-dominated battlefield; and - for a specified combat task - it costs more to get the job done with this type of aircraft than with other aircraft now available...I recognize your interest in actual flight test data; however the Enforcer presents no technical unknowns and its capabilities are easily determinable with great confidence. No data resulting from a flight test would impact on the factors which provide a basis for our conclusions. Because of this, we cannot justify or support a request to expend funds to provide redundant or unnecessary data...In view of your interest in the Enforcer aircraft, I suggest that you may wish to be briefed on the Air Force study. I understand that Dr. McLucas, Secretary of the Air Force, has already offered to arrange such a briefing at your convenience.

This response would seem, to most readers, to close the books on the Enforcer. With the exception of politically motivated "end runs" such as that with the A-7, the Congress seldom became involved to this degree with weapon systems not yet in production. They are intimately involved, of course, in the entire acquisition cycles of the few major systems presented each year such as the Trident submarine or the MX missile - these programs elicit national attention and arouse even the most apathetic taxpayer's curiosity. But the majority of programs of the size of the close air support aircraft program are nearly lost in the noise until there are visible problems in production. Congress usually sided with Defense in early program decisions such as the A-10 go-ahead. What may have been different about the Enforcer was the magnetism and tenacity of its designer and his persuasiveness while lobbying for its acceptance.

B. PRIVATE SECTOR INVOLVEMENT

Mr. David Lindsay was not completely discouraged by the results of the Air Force analysis which follow in Chapter VII. He knew he had won some powerful friends over to the Enforcer concept and that it would not die of neglect after the computer study and Air Force decision not to consider it for further testing. Instead of giving up he became even more determined and gathered together a briefing group consisting of Mr. Helms, the ex-military pilots who had flown the Enforcer for Piper in PAVE COIN, the British armor manufacturer, and the engine manufacturer. Many of the members of the subcommittees he had briefed and their staffs now knew more about the Enforcer concept than some of the Air Force managers assigned to its analysis and these committee members were just as annoyed as Mr. Lindsay that the Air Force chose to compare the Enforcer with the A-10 in the A-10's special and demanding scenario. Whether or not the Air Force's hands were tied by the passion for computer-generated cost effectiveness analyses in the Pentagon, there were too many senators who were tired of explaining to their constituents why costs of existing systems always seemed to exceed earlier computer-generated estimates. In an unusual gesture of support from their friends in Congress, Messrs. Helms and Lindsay and their team were invited to appear before several subcommittees to testify on their own behalf. Mr. Lindsay himself was given carte blanche when he was introduced by Congressman Price to members of the House Armed Services Subcommittee on Research and Development with the following remark: [Ref. 19].

Air Force presented its findings during November and it is my understanding that Mr. Lindsay is not in full agreement with some of the data presented. At this time you may begin this morning's program and present the committee with any new data or information that you feel is pertinent to the Enforcer....

It is essential to see what was occurring here. An aircraft designer, no longer even owner of the rights to that aircraft, was allowed to brief influential members of the subcommittee with information that they knew would discredit a study in which the service secretary had concurred. This was a courtesy seldom extended even to the giants of aerospace industries and an indication of the special status they reserved for Enforcer and its original owner/designer. Mr. Lindsay's remarks and those of the others on the briefing team will be discussed as part of the reaction to the Air Force analysis in Chapter VIII. What is important is that this team was immediately brought back before congressional supporters who clearly were dissatisfied with the continuing lack of sponsorship at DOD. Some Senators even proposed a face-to-face session between the Air Force and the Enforcer industry contingent before the subcommittee. It seemed they were almost forcing the issue into the limelight, giving the Enforcer a life of its own when all of their powers of persuasion with DOD senior officials had failed. These face-to-face briefings never occurred, nevertheless the friction, at least between members of Congress and the Air Force, is clear from a lively session in the summer of 1975 when the Air Force briefed the study in a partly classified session. This session will also be discussed in chapter VIII.

C. THE PPBS VERSUS ENFORCER

As the Enforcer program moved into the more active examination stage immediately following the Air Force analysis, a problem surfaced which remained unresolved for several years. It was noted that Enforcer was "born" partly out of what Mr. Lindsay correctly perceived as encouragement from Deputy Defense Secretary Packard's call for private sector

innovation. The language of the Armed Services Procurement Regulations in this regard is complex and subject to various interpretations. While there is supposed to be protection of proprietary rights and waiver of some of the usual provisions concerning release of data, competition, patent ownership, etc., for unsolicited private sector system proposals, questions were being raised in the case of Enforcer. Much of the profit potential associated with the sole source designation would be lost if Enforcer were subject to the competitive procurement procedures before prototypes could be built. This legal "skirmish" will be discussed in Chapter VIII as part of the Air Force responses to the questions raised by the Enforcer industry contingent.

Still another vexing problem which has been mentioned several times previously was actually tied to Planning, Programming and Budgeting System provisions. This anomaly, whimsically referred to as the "not invented here" syndrome by Mr. Lindsay in earlier testimony, is counter to the intent of Packard's remarks and of the protective clauses in the A.S.P.R. alluded to above. It is the bureacratic approach to the Enforcer's lack of sponsorship, and was best described by Mr. Lindsay himself before the House Armed Services R & D Subcommittee: [Ref. 20].

We are at the point today where the Pentagon has been forced to admit that the Enforcer will do all we have claimed, and at a very low acquisition cost. The bar now to operational flight tests is a remarkable conclusion, that because there is no sponsoring service, there is therefore no 'requirement' for the aircraft. We are thus back to square one: there was no official 'requirement' when our efforts began but a very obvious need. That need becomes clearer daily as studies indicated the necessity of supplementing sophisticated and expensive systems.

It seemed Mr. Lindsay and his group would be overwhelmed by conflicting regulations with interpretations that could be fashioned to the problem at hand, but both technicalities

were ultimately resolved. Congress was not in a mood to allow the services to avoid the tougher questions by citing unclear regulations, and both proved insufficient to prevail.

VII. THE AIR FORCE ANALYSIS

A. TACTICAL AIRCRAFT COMBAT MODELING

The true test of any piece of military hardware comes with the adverse conditions presented in a military battle. The battlefield, the ultimate testing ground, is also the least desirable environment in which to test a new piece of hardware. Testing and evaluation must be carried out prior to engaging the enemy to detect and correct weaknesses prior to battle.

Alternate approaches such as simulation allow the evaluation of a weapon system to occur without suffering actual combat losses. The "most likely" environment must be simulated through mathematical models which attempt to quantify weapons effectiveness and attrition rates against expected enemy defenses. Simulation, the primary method for development and evaluation, cannot measure the full capability of a weapon system. Spinney cautions analysts against total reliance on quantitative analysis: [Ref. 21].

Capability, like complexity, is a quality of the 'whole' and it can never be described by a single number. Recall from Generals Clark's and Napoleon's statements that the synthesis of men and machines into a military capability involves very important intangible considerations -- e.g. moral strength, esprit de corps, skill, etc. Any evaluation that ignores these intangibles is at best a very partial and, by necessity, an ambiguous view.

The acid test of war is ultimately the only unambiguous indicator of capability. Moreover, the lessons of combat continue to be difficult to interpret. All other indicators or measures are ambiguous because they are based upon speculation about a future interaction between forces whose self interest and survival dictate that they act and react

unpredictably. (note: if you are predictable, you are vulnerable.) We can reduce part of this uncertainty through testing and training, but we can never remove its dominant aspects. Perceptions of capability will always be shrouded by a veil of speculation and ambiguity. How does one compute the effectiveness of esprit de corps? [Ref. 22]

Although the modeling approach to design and evaluation of a weapon system is not as accurate as might be desired, it presents a starting point or basis from which the weapon system can be built and evaluated. To design a model for the close air support mission, for example, it is first necessary to determine the scenario. Given a scenario, aircraft are then postulated that could counter and eliminate the various threats within the scenario. This is the "transformation" from threat to program discussed in previous chapters and includes the creation of a specific operational requirement. This was the approach taken in the design of the A-10 aircraft to meet the U.S. Air Force close air support requirements.

As discussed in Chapter V, a reorientation to a European scenario was a characteristic of planning in 1974. NATO forces must be able to counter any Soviet thrust before its momentum builds up to the point where it will overwhelm the ground forces. NATO tactical aircraft losses will be considerable in this scenario, but they must be accepted if one also accepts the criticality of the threat and the projected short duration of the conflict. In 1974 it was U.S. policy to place a high priority on support of the NATO forces in central Europe. It follows, then, that attrition assumptions are critical to the outcome of any simulations of the NATO-Europe close air support scenario.

In studying the potential anti-aircraft threat in Europe, one finds an assortment of radar SAMs, infrared SAMs and radar-controlled AAA. The close air support attack is

associated primarily with aircraft-carried 30 mm firing passes against tanks. It has been demonstrated historically that bombs are not as effective for use against tanks as are aircraft-mounted 30 mm cannons. There is no substantial evidence to the contrary as more and more experience is gained. With an optimum slant range in a firing run of, for example, 4000 feet for the GAU-8 30 mm cannon (with the aircraft at approximately 1400 feet above ground level), attacking close support aircraft can expect to be exposed to all three anti-aircraft threats above. This is "dirty work" in the Air Force jargon. The high concentration of such systems in the Warsaw Pact will take a heavy toll among attacking NATO c.a.s. aircraft, especially in the low altitude regime from which the most effective attacks are commenced. Miller sums up the problem in a 1975 article: [Ref. 23].

Viewing the anti-aircraft order-of-battle in east and central Europe it is apparent that NATO will be taking very heavy losses in close-air-support operations behind enemy lines. Air Power does offer the capability to strike the massing enemy prior to the enemy's attack in force. NATO must, however, be prepared to accept high aircraft losses to effect a neutralization, or at least blunting of the enemy armoured striking forces. NATO's air forces then, must select the optimum aircraft(s) to maximize the damage to the enemy while minimizing the cost to NATO.

One can expect attacking enemy armored units to lose some of their anti-aircraft capability as they advance into friendly territory. This is due to the normal logistical strains put on any attacking forces as they advance because of the accompanying lengthening of the distance from the source of supply. There is a paradox here: the enemy forces are more vulnerable as they advance, but they are closer to critical positions being defended; conversely if the defending anti-tank aircraft are directed at armored units beyond the forward edge of the battle area (FEBA) into enemy territory,

those aircraft will suffer high losses. They will also blunt/neutralize the enemy's attacking strike force.

Although there has been considerable interest in, and advancement of, anti-tank weaponry such as the TOW missile and the GAU-8 30 mm cannon, the Soviets still build a striking force around tanks, and have placed more and more reliance on them.

NATO finds itself in a position of facing a potential enemy bent on maintaining the offensive. Anti-tank aircraft offer NATO the option of blunting this massive enemy attack capability before the full offensive weight can fall on its ground forces.

The analyst must consider weather factors in addition to the preceding enemy tactics assumptions. The limiting effect of typical weather in the European intertheater is substantial. There are simply too many days during which tactical air power would be useless if the payloads consisted entirely of "smart bombs", cluster type bombs (rockeye) and air to ground missiles. Even if they could find the enemy armored positions in bad weather, pilots would often be unable to achieve the release parameters of the above weapons.

On the other hand, 30 mm cannon-equipped aircraft are in many cases already below the weather because of the weapon's optimum effective firing slant range of 4000 feet, placing the aircraft 800-1500 feet above ground level depending on the dive angle. Analysts for U.S. forces favored the General Electric GAU-8 and the Hughes-Oerlikon model 34 pod from among those available in the mid-1970's.

Scenario, weather and weapons must be fitted to the model. For comparison between aircraft, the effectiveness model would examine each through all phases of its combat missions and estimate the probability of completing each phase. For close air support, the aircraft might be required

to 1) take off from a surviving base, 2) retain in-flight reliability, 3) survive enemy action, and 4) return to a surviving base. [Ref. 24]. When the final outcome of a battle is determined through computer simulation, the overall cost-to-kill ratio would be imputed and weighted for each aircraft. The aircraft with the lowest cost-to-kill ratio would, mathematically at least, be the lowest cost option.

NATO doesn't have unlimited air resources, and the most efficient and effective use of available assets is necessary. In some important ways the number of aircraft in service is irrelevant; what counts is how many sorties can be generated and how quickly. For example, in many c.a.s. scenarios, a squadron with ten aircraft capable of five sorties each per day is more effective than a twenty-plane squadron whose aircraft can only fly twice a day. This same line of reasoning is true of pilots. The sortie generation rate is important in keeping pressure on enemy forces and precluding disengagement. [Ref. 25]

Given the above emphasis on survivability and weapons effectiveness assumptions, an Air Force study evaluated the A-10 against the Enforcer. It is described in the next section.

B. AIR FORCE ANALYSIS

In late 1974 as the pressure to legitimize Enforcer (Chapter VI) was increasing, the Air Force directed its Aeronautical Systems Division and elements on the Air Staff to conduct a formal evaluation. [Ref. 26]. The objectives were to: 1) compile comparative data for other aircraft, 2) assess the potential for U.S. Air Force use of the Enforcer concept, and 3) evaluate a proposed prototype flight test program. The ASD portion involved about 40 man-months of

effort by its engineering, financial and test personnel. The Assistant Chief of Staff for Studies and Analysis at Air Force Headquarters conducted an operational effectiveness evaluation in a NATO scenario.

The Air Force technical evaluation at ASD focused on a Piper-Lockheed modified Enforcer proposal including stiffer engine mounts and a new horizontal tail. Data and information were generated from discussions with Lockheed and with Mr. Lindsay and from inspection of the existing prototype and related material. Features evaluated were: 1) structure and weight, 2) aerodynamic drag, 3) propellor/engine performance, 4) stability and control, 5) selected subsystems, and 6) vulnerability. Results correlated reasonably well with the predictions of Lockheed and Mr. Lindsay. A cost evaluation was conducted for a two- and four-aircraft prototype program, a follow-on full scale development program, several production programs, and for the annual operating and support costs of a typical Enforcer squadron. The results are summarized in Table I below.

The proposed full scale development program included development of the military subsystems and comprehensive ground and flight testing of six additional test aircraft, leading to a production version of an operationally configured weapons system.

The 733-unit production proposal for the Enforcer included non-recurring costs, recurring costs of the aircraft supporting ground equipment, training equipment, data and spares. Where possible, the evaluators compared the Enforcer program above with a 733-unit program of A-7D, A-37, OV-10, and A-10 aircraft. The results suggested that if there were a place in the Air Force inventory for an Enforcer it would be in lieu of, or in a high/low mix with, the A-10. Most of the A-7D capabilities were for missions other than c.a.s., the A-37 was in a phase-out and had very

TABLE I
FOM Program Cost Summary - 1975 \$ (In Millions)

Prototypes (4)	\$ 10.8
Full Scale Development	129.9
Production (733)	<u>955.3</u>
Total Acquisition	\$1,096.0
Flyaway Unit Cost	1.06
Annual O & S Per Squadron	8.5

Source: USAF Briefing
Team

limited c.a.s. capability, the F-4 was primarily an interceptor and the OV-10 was never used in a c.a.s. mission. Table II compares the above Enforcer costs with estimated A-10 costs in the same categories.

ASD engineers also evaluated performance data for both aircraft and concluded that the aircraft were similar in the categories of takeoff roll, landing ground roll, flotation characteristics (tire characteristics and clearances for unprepared field operations), maximum speed, loiter time v. radius of operation, and vulnerability. This data enabled the Air Force to design an equal-effectiveness model between the A-10 and the Enforcer.

TABLE II
A-10/Enforcer Cost Comparisons

	<u>A-10 3-31-75 SAR baseline</u>	<u>Enforcer 3-31-75 SAR formatted</u>
	(\$ In Millions)	
DEVELOPMENT	\$ 364.2	\$ 140.7
PROCUREMENT	2064.7	955.3
PROVISIONS FOR ECONOMIC CHANGE	730.8	348.1
TOTAL PROGRAM	\$ 3159.7	\$ 1444.1
PROCUREMENT UNIT COST	3.81	1.72
PROGRAM UNIT COST	4.25	1.94
<u>QUANTITIES</u>		
DEVELOPMENT	10	10
PROCUREMENT	733	733
AVG FY-75 FLYAWAY UNIT COST	2.23	1.06

NOTES: 1975 dollars for out-year development

Development quantities include 4 prototypes
for each aircraft

Overall bottom line: Enforcer costs 45% of A-10 (unit)

Armed with the above performance and cost data, Air Staff personnel conducted a cost-effectiveness comparison by inserting both aircraft into a worst-case scenario - a

massive tank assault (called a breakthrough) into NATO's central European theater with its severely hostile air defense environment. This was the scenario for which many of the A-10's more sophisticated features (wing loading, internal 30 mm cannon, armor plating) were optimized. Using the valid methodology used in a previous A-10/A-7D comparison, equal-effectiveness numbers were computed and costed out. The source of all of the analysis data in this chapter except Tables III and IV is the Air Force briefing team presentation to House and Senate subcommittees in 1975.

Figure 7.1 below shows an overview of the computer programs used in the analysis.

Two specific anti-armor configurations were considered, with the assumed daylight configuration shown below in figure 7.2. The ALQ-119/131 are electronic countermeasures pods. The ALE-37 is a chaff/flare dispenser. For nighttime operations (under flares), appropriate quantities of rock-eyes were substituted for the Mavericks, 18 for the A-10 and 4 for the Enforcer. Any adverse effect of the somewhat overloaded condition of the Enforcer in this configuration was ignored, as was any possible performance degradation by the clustered 106 mm recoilless rifles on the wingtips. Finally, to consider the Enforcer in the best possible light in the initial evaluation, accuracy of the 106 mm rifles was assumed to be the same as the 30 mm cannon in the A-10.

For classification purposes, graphical results on figures 7.3 through 7.6 following have been normalized with the A-10 equal to one and the Enforcer results adjusted accordingly.

Figure 7.3 shows the relative probability of attrition and battle damage to Enforcer and A-10 against the defenses considered in the analysis. It shows the Enforcer subject to battle damage 1.8 times that of the A-10, with overall attrition 1.7 times that of the A-10.

ENFORCER EVALUATION **OVERVIEW OF COMPUTER PROGRAMS** **USED IN THE ANALYSIS**

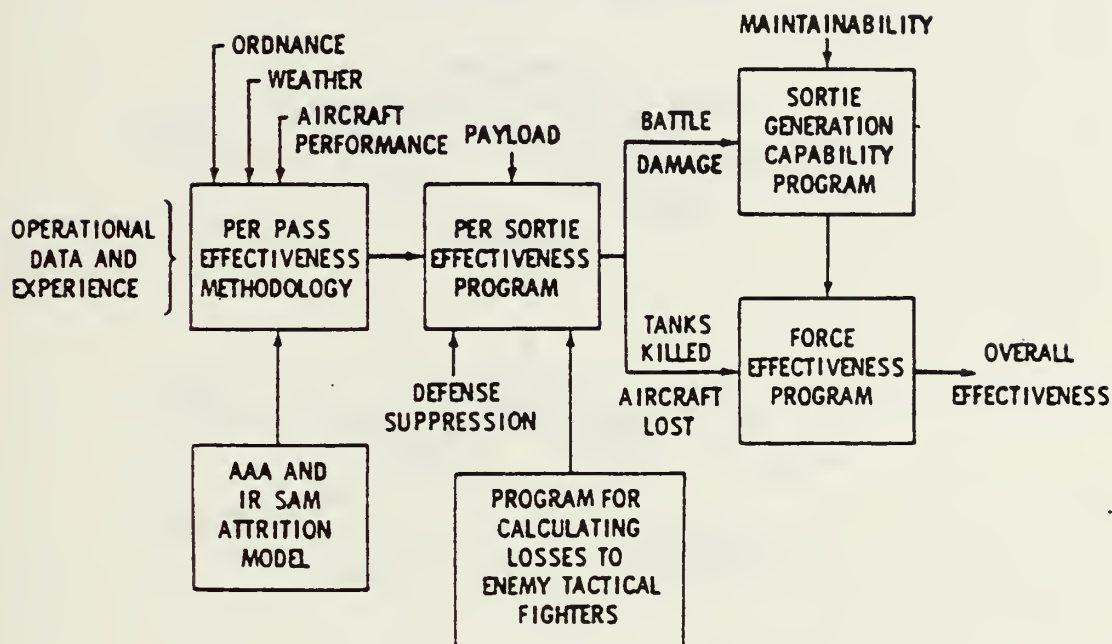


Figure 7.1 COMPUTER MODEL.

Figure 7.4 compares equal forces of 504 A-10s and 504 Enforcers. The aircraft curves represent percentages of tanks killed on a time basis up to day five. By the end of day five it is estimated that the A-10 has killed 70% more tanks than the Enforcer, or stated differently, it would take 888 Enforcers to match the five day effectiveness of the A-10, carrying a reduced load of six Maverick missiles. Although the study did assume equal accuracy for the two gun systems, the dotted line does illustrate the average degradation to be expected with wingtip mounted guns. In this case about 1048 Enforcers would be needed to match the A-10 five day results.

ENFORCER EVALUATION ANTI ARMOR CONFIGURATIONS

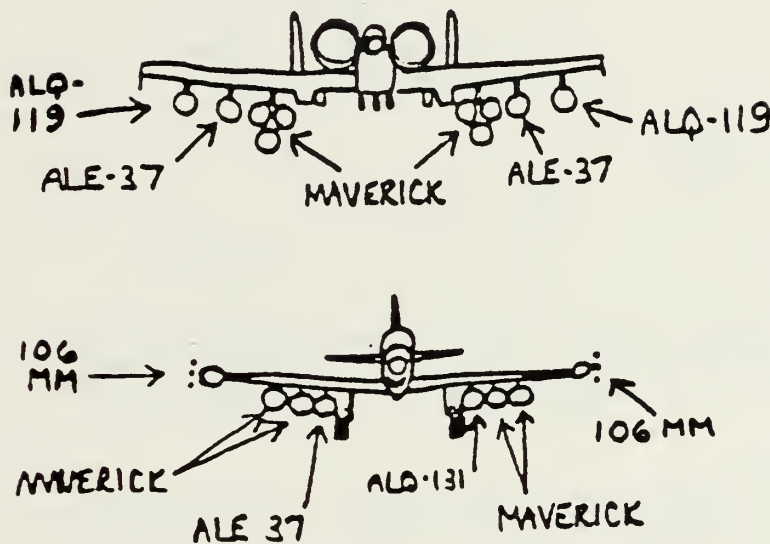


Figure 7.2 WEAPON LOADS.

Figure 7.5 illustrates the results when the A-10 carries its standard load of 10 Maverick missiles, with the Enforcer at its maximum load (same as figure 7.4). The dotted line illustrates expected real degradation from wingtip mounted guns. Here about 984 Enforcers (up to 1,161 with gun degradation) are needed to match the A-10 five day results.

Figure 7.6 compares bomb loads against combat radii. It shows that the A-10 can carry almost four times the unrefueled external payload on approximately the same radius mission, achieving the same loiter time as the Enforcer.

ENFORCER EVALUATION

ENFORCER ATTRITION PER SORTIE RELATIVE TO A-10

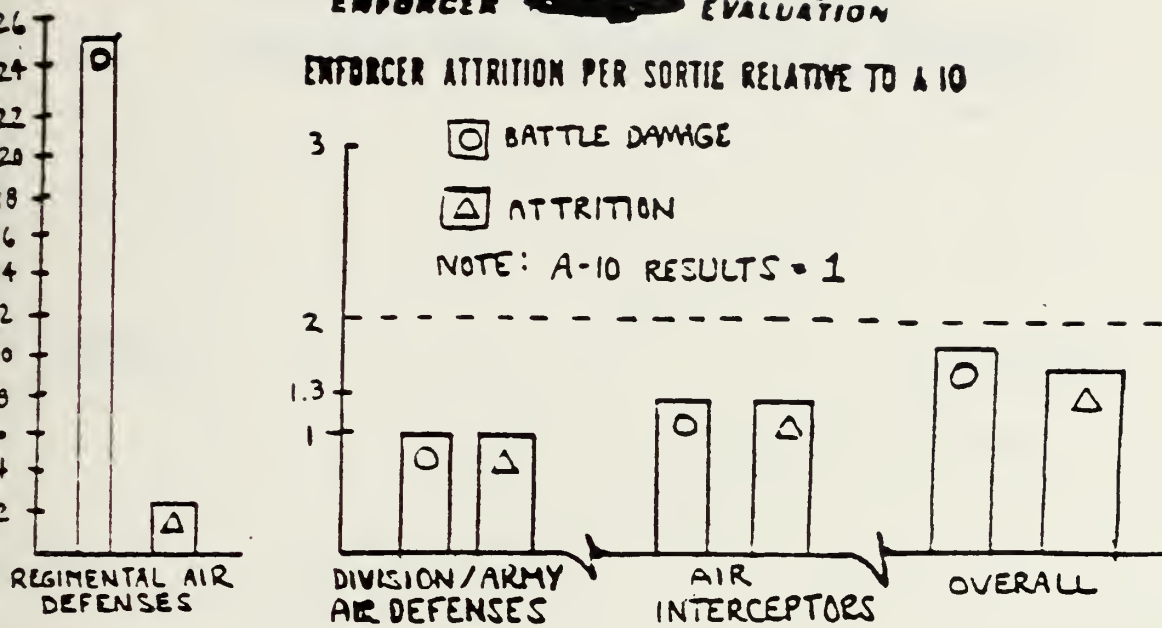
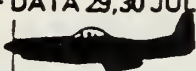


Figure 7.3 ATTRITION COMPARISON.

USAF DATA 29,30 JULY 1975

ENFORCER



EVALUATION

FORCE EFFECTIVENESS (BASELINE A-10 W/6 MAVERICKS)

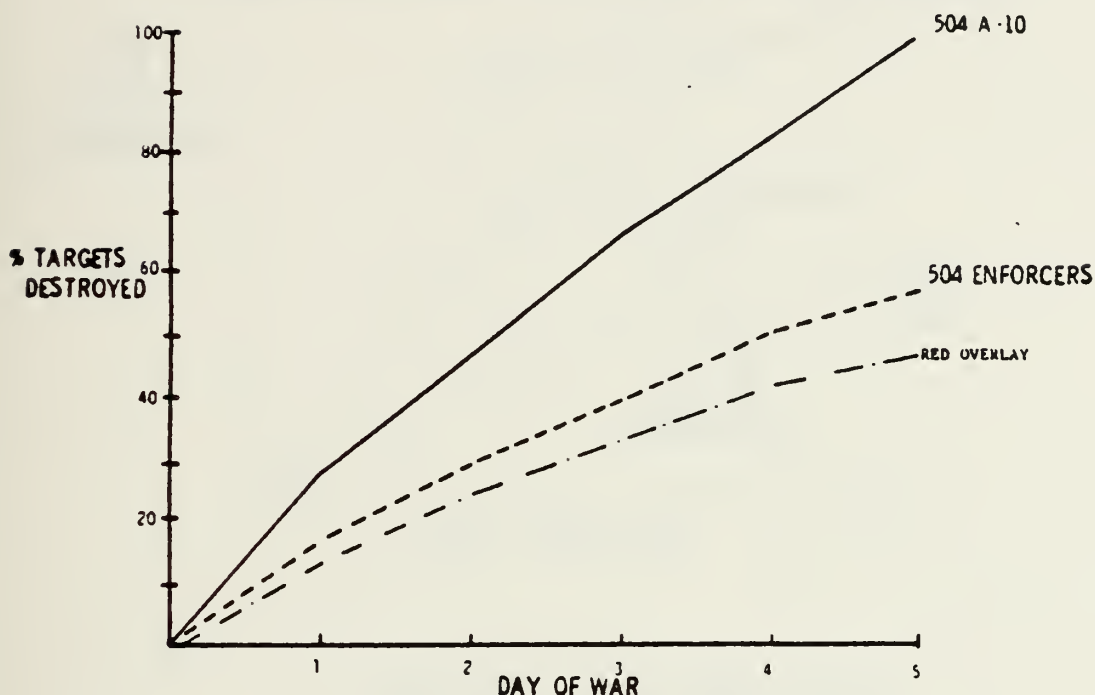


Figure 7.4 REDUCED LOAD.

Another measure of capability and potential effectiveness can be derived by comparing guns. Figure 7.7 depicts the relative effectiveness of two-second bursts against various ground targets by the GAU-8 30 mm cannon used in the A-10, by the M-61 20 mm cannon used in the F-4, F-15 and F-16, and by the six M-3 50 calibre machine guns in the proposed production Enforcer. For classification purposes, the estimated actual GAU-8 30 mm single pass kill probability has again been normalized to one and the M-61 and M-3 figures adjusted accordingly. The Chart illustrates that only the GAU-8 has any capability against a heavy tank, and

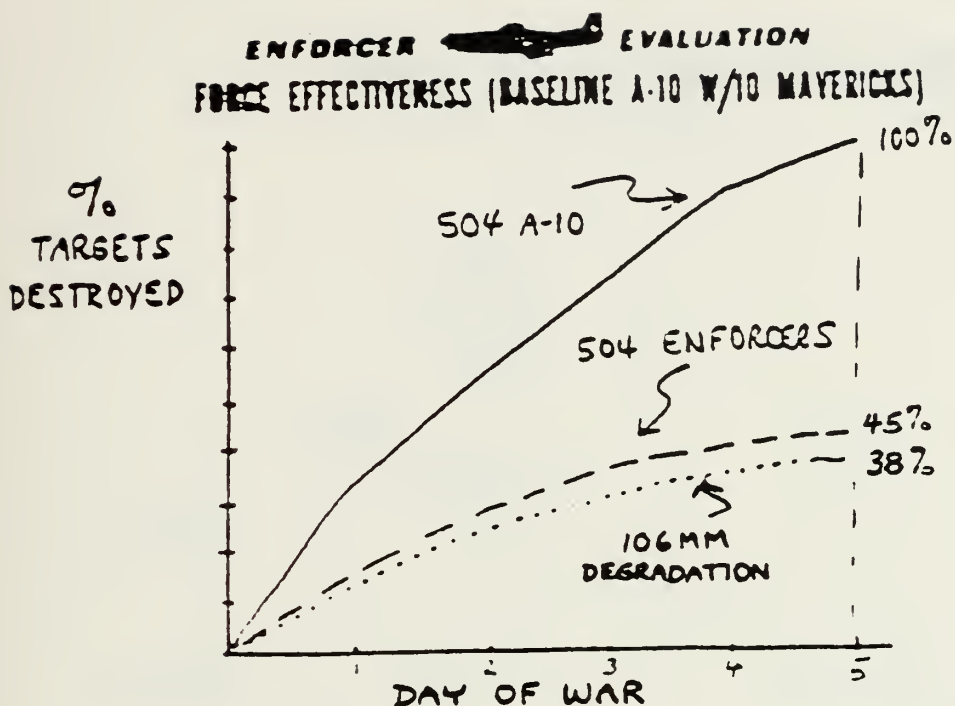


Figure 7.5 STANDARD LOAD.

also is considerably more effective against the other targets illustrated.

C. RESULTS OF THE AIR FORCE ANALYSIS

The unit flyaway and program unit costs of the Enforcer were estimated at about 45% of the corresponding A-10 costs. The annual operating and support costs for the Enforcer were estimated at about 80% of those for the A-10. The A-10, however, was determined to be from two to four times more effective than the Enforcer depending on the scenario. These characteristics were used to evaluate costs of those combinations of Enforcers and A-10's illustrated in Tables III and IV. This evaluation determined an all-A-10 force to be the most cost effective and concluded that there was no place for the Enforcer in the Air Force inventory.

ENFORCER**EVALUATION**

ENFORCER/A-10 RADIUS COMPARISON

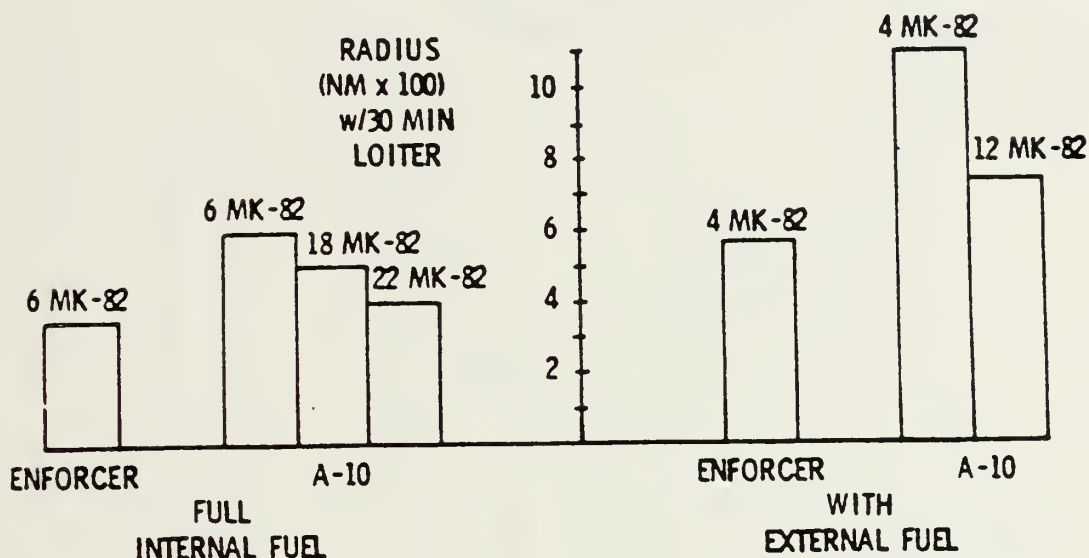





Figure 7.6 COMBAT RADII.

Tables III and IV expand the above mix options for a procurement of 733 aircraft in terms of cost versus weighted effectiveness. The cost basis used for the calculations was the August 1975 unit flyaway cost of \$2.23 million for the A-10 and \$1.06 million for the Enforcer. Table III considers the upper estimate of effectiveness. This 4:1 effectiveness ratio is normalized to the A-10, resulting in an A-10 effectiveness of one and Enforcer equal to 0.25. Intermediate effectiveness of a mix of A-10's and Enforcers is computed by using a weighted average based on a total force of 733 aircraft.

ENFORCER **EVALUATION** **GUN COMPARISON**

RELATIVE SINGLE PASS KILL PROBABILITY
OPEN FIRE 3000'

-  GAU-8 30 mm
-  M-61 20 mm
-  6xM-3 50 CAL

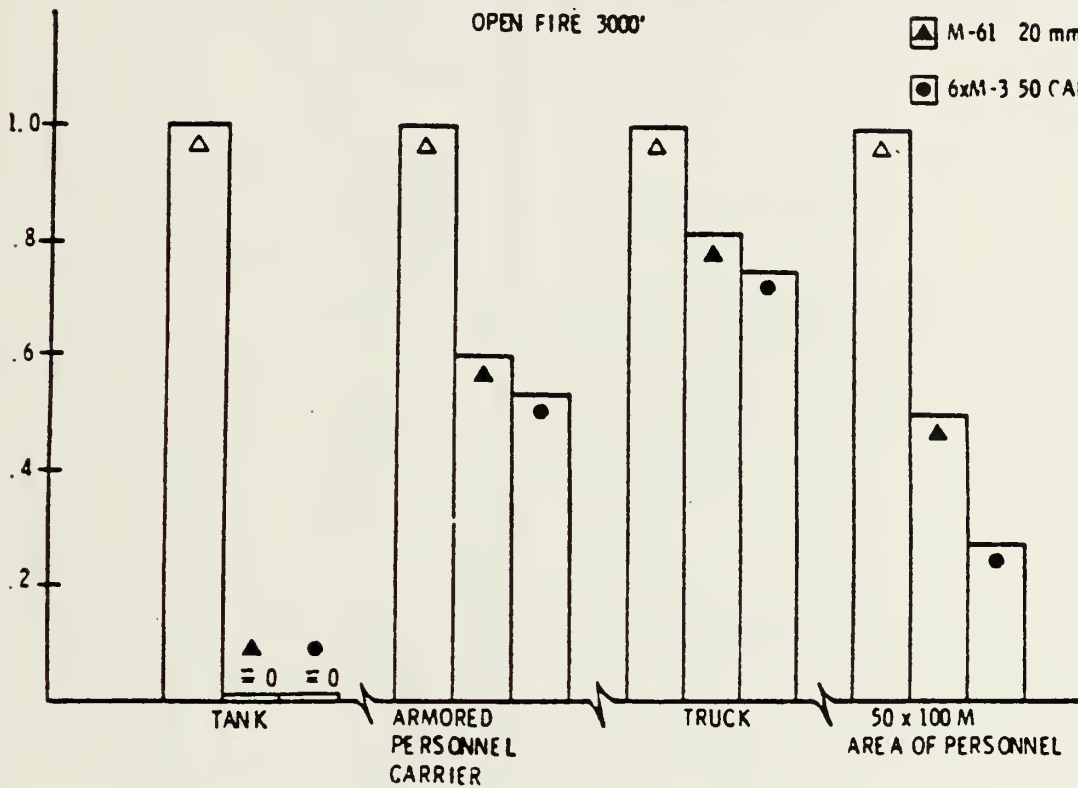


Figure 7.7 GUN KILL PROBABILITIES.

TABLE III

Upper Estimate of Effectiveness

CALCULATION OF FORCE EFFECTIVENESS WEIGHTED AVERAGE

$$\left(\begin{array}{c} \text{Percentage} \\ \text{of A-10's} \end{array} \right) \times \left(\begin{array}{c} \text{Normalized} \\ \text{Effectiveness} \\ \text{Ratio} \end{array} \right) + \left(\begin{array}{c} \text{Percentage} \\ \text{of} \\ \text{Enforcers} \end{array} \right) \times \left(\begin{array}{c} \text{Normalized} \\ \text{Effectiveness} \\ \text{Ratio} \end{array} \right) = \text{FEWA}$$

FORCE MIX		FLYAWAY COST (MILLIONS)		TOTAL	WEIGHTED EFFECT- IVENESS	COST/WEIGHTED EFFECTIVENESS
Number A-10's	Number Enforcer	A-10	Enforcer			
733	0	1634.59	- 0 -	1634.59	1	1634.59
533	200	1188.59	212	1400.59	0.80	1750.74
433	300	965.59	318	1283.59	0.69	1860.28
333	400	742.59	424	1166.59	0.59	1977.27
0	733	- 0 -	777	777.00	0.25	3107.92

From Table III it is clear that the least costly force of aircraft would be an all-Enforcer mix for a flyaway cost of \$776.98 million if effectiveness were excluded. When the effectiveness measure is introduced the all A-10 force becomes the lowest cost option.

Table IV examines the low estimate of the effectiveness range wherein the A-10 is considered twice as effective as the Enforcer. This ratio is again normalized to the A-10 with A-10 equal to one and Enforcer equal to 0.50. The 2:1 ratio calculations indicate that both the lowest cost aircraft and the lowest cost "mix" option with effectiveness considered is the all-Enforcer structure. It also appears that the minimum effectiveness ratio would be 2:1 since the difference between the total weighted effectiveness costs of an all-A-10 force and an all-Enforcer force is \$80.63 million. This amount is approximately 5% of the total flyaway cost and is immaterial. Note that this analysis did not consider the higher unit costs of a smaller procurement or a stretched-out buy, nor did it address the effect of using program unit costs reflecting life cycle considerations. Inclusion of life cycle O & S costs could alter the results significantly unless the costs were proportional to flyaway costs. There was no consideration of the costs of training replacement pilots where pilot loss was assumed.

TABLE IV
Lower Estimate of Effectiveness

FORCE MIX		FLYAWAY COST (MILLIONS)		TOTAL	WEIGHTED EFFECT- IVENESS	COST/WEIGHTED EFFECTIVENESS
Number A-10's	Number Enforcer	A-10	Enforcer			
733	0	1634.59	- 0 -	1634.59	1	1634.59
533	200	1188.59	212	1400.59	0.87	1609.87
433	300	965.59	318	1283.59	0.79	1624.80
333	400	742.59	424	1166.59	0.72	1620.26
0	733	- 0 -	777	777.00	0.50	1553.96

D. CRITIQUE OF THE MODEL/ANALYSIS

The Air Force did a creditable job constructing a meaningful evaluation/comparison between the Enforcer and the A-10. A-10 data were derived from early flight testing and hands-on experience. Enforcer data accepted by the Air Force were largely engineering estimates of the manufacturer and designer. The Air Staff evaluators gave an edge to Enforcer wherever possible. On the other hand, Enforcer was not developed against a specific operational requirement. The A-10 was developed precisely for optimum performance against the threat scenario used in the analysis. The Enforcer was optimized for day, visual, close air support of ground troops with a tank capability if needed. It had no deep interdiction provisions. The A-10 had more sophisticated instrumentation and avionics, was literally built around the GAU-8 gun system for optimum performance as a heavy tank killer. As mentioned in earlier chapters, attrition estimates were significant in determining the outcome of the analysis. The use of a five day scenario could be questioned when the three day scenario was widely used by the NATO planners during the 1970's. The operations and support costs of the Enforcer were pure guesswork and appear high, but it is difficult to fault the Air Force for a high side estimate when there was no operational data available. (generation of this critical data was one of the reasons cited by the manufacturer and designer for scheduling operational test flights). Whatever the arguments, even in the best case for Enforcer with its slight total program cost advantage the approximately \$2.0 million extra for the A-10 as an alternative buys a lot more capability in environments within which the Enforcer could not operate.

The analysis therefore, has its flaws. The Enforcer's sensitivity to the harsh scenario chosen is obvious. If the

scenario were reduced to an infantry skirmish with, perhaps, mechanized troop carriers or fighting vehicles the Enforcer emerges as the most cost-effective choice. Enforcer was born to lose in the fight it was thrust into, but there were many supporters of the heavy tank breakthrough/five day war theory in 1974. Arguments can be fashioned to persuade a listener in either direction, as with most computer analyses, but the edge is always given to the higher technology option. Following a headquarters review of the analysis results, the Air Force dropped the issue of formulating a test plan on the grounds (initially) that it would lead nowhere. Their justification is summarized from the text of the analysis: [Ref. 27].

No mix provided a more cost effective force than an all-A-10¹ program, either in terms of future capital investment, total acquisition, or life cycle cost.

Today the analysis is of historical interest only since the A-10 is out of production and its costs are sunk. Chapter VIII follows the program from the conclusion of the Air Force analysis to the present, through a turbulent period during which the Enforcer's congressional and industry sponsors persisted to the point of providing supplemental funding for the test program.

VIII. ENFORCER PROGRAM 1975-1984

A. CONGRESSIONAL REACTION/AIR FORCE RESPONSE

Chapter VI discussed the substantial pressure building in Congress to find a service sponsor for Enforcer and to provide for a modest test flight program. The Air Force consistently referenced the computerized cost effectiveness analysis results and raised the issue of compliance with procurement regulations. After the first round of written requests from various committee members in Congress during 1974 generated an across-the-board "not interested" reply from DOD, one might have expected the Enforcer issue to have died. Instead, its support grew stronger and during the spring of 1975 several hearings were held to air the manufacturer's concerns over the Air Force evaluation and to provide the Air Force with an opportunity for rebuttal.

Between April and July of 1975 subcommittees of both the House and Senate Armed Services Committees conducted lengthy sessions with the industry group (primarily Messrs. Lindsay and Helms) and with the Air Force, represented by Lieutenant General James Stewart, Commander of the Aeronautical Systems Division, Air Force Systems Command. [Ref. 28].

The focus of the Air Force testimony was on the analysis and both the House and Senate Armed Services Research & Development Subcommittees had numerous questions concerning inconsistencies and inaccuracies. There were the usual courtesies at the outset followed by formal summary of the analysis. It then became evident that the congressmen and senators had been well prepared for the hearings by their staffs and perhaps by the industry group whose testimony preceded the Air Force session. There was, however, nothing

substantial enough resulting from the cautious give-and-take and in the various challenges to raise serious questions about the study results themselves. Since Congress chose not to kill the Enforcer issue based on the study results it was probably not the subcommittees' intentions to reverse anything. It seemed instead that the long discussions about minor points in the analysis was intended to place the Air Force in a slightly uncomfortable position prior to more probing questions. The following one-sided exchange between Senator Thurmond and General Stewart indicates that at least one powerful Enforcer sponsor thought that the Air Force was dodging the real issue: [Ref. 29].

(Senator Thurmond). I have a few questions here to be propounded, but I would suggest that you gentlemen not just toss this thing lightly aside; not just come over here and oppose it for the sake of opposing it, but be openminded on it. And that is the way I have been on this thing, because I have heard both sides of it. But it seems to me that it is well worth making this test to find out where we stand on it. If it does not prove out, OK. If it does prove out, you will certainly want it. I assume that you do have an open mind on it, do you not? (General Stewart) I hope so sir. (Senator Thurmond). You hope so? Well, why do you not? It is your business to have an open mind on matters that are for the best interest of the taxpayers. If this plane is successful and can do the job, it can be bought for \$1 million, where you are going to have to pay \$4 million for the A-10. Why would you not want to use these where you can, and use the A-10's where you cannot do this? If you have got your mind shut, there is no use for me to say any more. If you have made up your mind what you want to do, and are not willing to keep an open mind here, I do not care to ask you anything else, or say anything else. But if you have got an open mind - and I think you ought to have - then it seems to me that you ought to be willing to consider saving the taxpayers some money; because I am fighting all I can for the Defense Department, and we are having a hard time, and when we suggest something here that might save some money that would accomplish the purpose, we think you ought to consider it. (General Stewart). Yes, sir.

The bad chemistry between these two was evident but the point was made. Senator Thurmond had been receiving briefings on the pros and cons of the Enforcer for four years, and the bottom line for him was that the analysis seemed

only a convenient way for the Air Force to brush the system aside, without recognition of the larger question of its overall suitability for what it was optimized for. What seemed only fair play to the Senator would be viewed by the Air Force as not in accordance with sound acquisition procedure, and, of course, a threat to the A-10 program integrity.

The sessions were at an impasse with respect to the Enforcer program, but there was a sense in the subcommittee that it would eventually move forward again. The Air Force analysis, their primary excuse for not considering a test program for Enforcer, was dismissed by some of the senators as incapable of properly addressing the Enforcer's real capabilities. While the Air Force still narrowly viewed the aircraft as an outsider threatening their established program's integrity and production plan, subcommittee members tended to consider it on a stand-alone basis which left the Air Force clinging to the A.S.P.R. violation issue. [Ref. 30]

The Air Force position on the legality of Enforcer's test proposal was a complex one. They based a refusal to test the aircraft with their own funds on a combination of requirements. OMB Circular A-109 directs the services to first obtain Secretary of Defense approval for a mission need statement, and then to explore alternative solutions to the mission need. The next phase in acquisition, exploratory development, requires solicitation of competition under the provisions of DOD Instruction 5000.1 and page 8 of the A-109 Circular. The subsequent demonstration and full scale development phases require parallel development of competitive prototypes wherever feasible under provisions of the same two directives. The production phase introduces provisions of 10 U.S.C. 2304 (a) (10) as implemented by A.S.P.R. 3-210 and 10 U.S.C. 2304 (a) (14) implemented by A.S.P.R. 3-214

allowing sole source contract awards in certain circumstances. The Air Force position, therefore, led to an impasse because it maintained that Enforcer was not sponsored by a service in response to a mission need in the first place, and that it did not meet the criteria for sole source production award even if non-Air Force money were provided for the test program. [Ref. 31]

The industry group countered with a lengthy opinion prepared by Mr. Lindsay's counsel, Mr. Loren K. Olson, which concluded that Enforcer could legally be procured by the Air Force for flight test and subsequent production. The key directive permitting this was again the A.S.P.R., specifically sections concerned with contractors' rights in cases of private development with private funds - in other words sole source was authorized, eliminating the Air Force insistence on competition. [Ref. 32]

It seemed that all that remained was identification of the resources. Congress, choosing not to challenge the Air Force's continued insistence that expenditure of Air Force funds for any Enforcer-related project would violate the mission need statement requirement of Circular A-109, decided to attempt passage of a separate appropriation. It would have been "fenced" for the exclusive use of the Air Force to purchase prototype Enforcers and test them. Just when it seemed Enforcer was off and running with a \$5.6 million dollar appropriation nestled in the fiscal 1978 defense appropriation, it was knocked out of the race by political "sour grapes" The congressional antics were summarized in a Washington newspaper article. [Ref. 33].

The services have firmly resisted a full-scale flight test for the smaller plane for more than three years, claiming that there is no requirement for it...For a time, it seemed that the Congress might decide otherwise. Last month, a Senate defense subcommittee voted unanimously to include \$5.6 million in a Pentagon appropriations bill to pay for the building and testing of four prototype models of the fighter...But apparently

there is no reckoning with the resistance of the service bureaucracy or of the old-school ties on Capitol Hill. In what amounted to a jurisdictional dispute over the authorization, Sens. Barry Goldwater, R-Ariz., and Howard W. Cannon, D-Nev., both Air Force generals, combined forces to get the sum knocked out of the bill as a 'waste of money'...As a result the Enforcer, which just might have saved the American taxpayer several billions, is back on the old drawing board.

It wasn't to remain on the drawing board for long, however. The funds were appropriated the following year. One might observe that after six years of service inaction on the proposal, Congress was entitled to play political football with it for one season.

For a number of reasons ranging from delays at Piper to technical contractual difficulties to old fashioned foot dragging, the Air Force failed to spend any of the first appropriation. This generated a strong rebuke from Congress and a subsequent appropriation twice as large, \$11.8 million, for fiscal year 1981, to complete the program.

B. THE TEST PROGRAM

In January 1983, 12 years after the PAVE COIN demonstration, the Piper Enforcer began its modest test flight program. The first phase at Piper facilities in Lakeland, Florida involved about 175 flights. Test objectives were to establish flying characteristics including performance, flutter and air loads. Some on-board systems were also tested. In February 1984 it arrived at Eglin Air Force Base in Florida and began a 56-flight program of weapons separation tests and establishment of radar and infrared cross-sections. The final phase involves 74 operational demonstration sorties at Edwards Air Force Base in California. Final completion is expected in during the summer of 1984. [Ref. 34]

IX. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY REMARKS

The Enforcer history is one of a struggle on many fronts over a single issue: what is the most cost effective way to provide for our defenses in an atmosphere of resource constraints? Although the focus narrows to a relatively small program in a very specialized mission area, the much broader issue involving all defense acquisitions is mirrored by the Enforcer.

After more than a dozen years since its first exposure to the military, the Enforcer controversy is nearing an end. It is unclear what the final decision will be, but whether or not a decision to procure the Enforcer results, the characteristics of the struggle will remain. The issues which placed the Enforcer in the limelight are unresolved. These issues include, but are not limited to: the limits of congressional authority over weapons research and development spending, interpretations of the A.S.P.R. sole source guidance, objectivity in the process of developing specific operational requirements, elimination of interservice rivalries and parochialism from the weapons acquisition process, and the proper role of computerized cost effectiveness analyses in system evaluation.

Congress disagreed with the military on each of the above issues. It attempted to "insert" the Enforcer into the system with a legitimacy it didn't have. The missing ingredient was service sponsorship. It will never be known whether or not Enforcer might have competed successfully against alternatives, if any, had there been service sponsorship, or a specifically tailored O.R., or both (the more

likely case). What is known is that under the set of circumstances presented, the services were able to produce a variety of roadblocks to its success, ranging from the simple "foot-dragging" of the early 1970's to the sophisticated and complex legal objections when delaying tactics failed.

One of the reasons Congress kept the Enforcer program alive was their inclination to support the underdog, an underdog with persuasiveness and tenacity. To his credit, Mr. Lindsay never waived from his initial position with respect to what the Enforcer was trying to be and where he expected it to go. The Air Force proved inconsistent in testimony, jumped from one excuse to another for not testing the aircraft, and, now that it is being tested, has made some changes to the prototype unrelated to the aircraft's intended mission. Congress had a clear picture of what the Enforcer was designed to do, and what they wanted from the military was an operational flight test program to properly validate its designer's claims. Enforcer is an aircraft for the "dirty work" of close air support, the dangerous but necessary support of infantry fighting forces on the ground. This essential mission element of close support will remain a characteristic of conventional warfare between armies for the foreseeable future, and the United States doesn't have a system optimized for it. The Air Force was riveted on the central European tank breakthrough scenario, perhaps with good reason. There was nothing wrong with this emphasis except that the military tailored its force accordingly and in the process lost a few of the more desirable "dirty work" characteristics in their aircraft. Their front-line A-10 is inferior to the Enforcer in simplicity of operations, maintainability, fuel consumption at low altitudes, and turn-around time. It isn't clear whether or not these were conscious tradeoffs in designing the optimum tank killer aircraft.

B. CONCLUSIONS

Mr. Lindsay and the manufacturer insisted that Enforcer was designed to supplement the A-10 type aircraft and that it should not have been evaluated as an alternative to, or in combination with, the A-10. Despite their position, the economic facts of life throughout Enforcer's twelve year experience in DOD and in Congress precluded the supplement approach. It is inconceivable that any proposed buy of Enforcers during the 1970's would involve additional funds for hardware in the close air support mission area. Even if there had been a specific operational requirement for the Enforcer's "dirty work" scenario, a modest mix with the A-10 force is much more likely given the pressure to hold down spending. This story is, therefore, really one of a high/low mix candidate within existing funding constraints. None knew this better than the Air Force close air support program managers. A vote for Enforcer was a vote to reduce force levels in their A-10 program, or at least to stretch out the procurement. Their response was reasonable in the highly competitive environment of program management. Just as reasonable, however, was the response in Congress. Their decision environment was considerably different as they attempted a balance between a strong defense and taxpayer appeasement.

It is difficult to observe the priority Congress afforded Enforcer without observing that some of the credit for this belongs to Mr. Lindsay. After a meeting with Mr. Lindsay at his California home the authors are convinced that his twelve-year personal dedication to promoting the Enforcer concept all over the country and his testimony year in and year out to members of Congress kept the program alive in the face of adversity. Others came and went, but none were 100% privately funded like the Enforcer and none had a David Lindsay devoting a consistent, sincere effort.

Can a low cost alternative weapon system like the Enforcer find acceptance by the Defense Department in today's acquisition environment? The authors believe that service sponsorship is an absolutely essential ingredient to the acquisition process, although it won't be found in a milestone chart. Institutional resistance to an outsider, that "not invented here" syndrome Mr. Lindsay discussed, is a force powerful enough to hold back the Congress for twelve years. It won't dissolve overnight, and future Enforcers can expect the same long, uphill battle for formal recognition if they don't have equal influential backing somewhere in DOD. The flexibility built into the language of the acquisition regulations can and will be used by the services to sabotage congressional sponsorship. Service parochialism and rivalry remains as strong as ever, indeed to some degree it is desirable until it interferes with the rational decision-making process. Computerized cost effectiveness analyses are certainly not the ultimate test, but they are a valuable tool for comparison and they are getting more sophisticated every year. The only real limitation with analysis is the human input, the judgements and assumptions necessary to quantify a problem but critical to the results. Our system of checks and balances prevents spending abuses within the agencies, but it is a two-edged sword: the Congress is likewise limited in its ability to "steer" discretionary appropriations such as research and development into specific programs which are not already approved DOD programs. There has been change in the acquisition area since 1971, but it has been more evolutionary than revolutionary and a new Enforcer introduced this year might conceivably be with us in 1996, still searching for a sponsor.

C. PROJECTED ACQUISITION ENVIRONMENT

The defense budget is certain to be in the spotlight in an election year with record defense outlays and a growing deficit. The near-term strain on the defense budget submissions will test the ability of DOD to rise above politics and keep the major programs intact. The climate for introducing new lower cost alternative systems will never be better than in the the next five years. As of this writing an as yet unreleased GAO report paints a dismal picture for defense acquisitions through 1988: [Ref. 35].

A new congressional study, in a highly critical report of the Pentagon's budget planning, warns that actual military spending from 1984 through 1988 is likely to run as much as \$324 billion over original estimates and still be inadequate to buy all the weapons originally sought. The still-unreleased study by the General Accounting Office, Congress' watchdog on government operations, is heightening fears among lawmakers that the federal budget deficit could grow even higher than pessimistic forecasters now predict...The findings are certain to be troubling to those members of Congress who have been counting on defense cuts to reduce budget deficits that could climb from nearly \$200 billion this year to above \$300 billion by 1989...The GAO study found that the Pentagon underestimates costs in virtually every area of its budget, including regular operations and maintenance. But the largest miscalculations - two-thirds of the total overrun - involve weapon programs...

The projected acquisition environment for the next four years is not favorable for the big ticket systems. It may not even be favorable for low cost alternatives but they will certainly have a better chance than the high end. Congress can be expected to respond favorably to Enforcer-type offerings (privately funded and available in high quantities at low unit costs). It would be reasonable to assume that even at Defense some managers may reconsider lower cost alternatives that were previously cast aside, if only to take some of the pressure off of the larger systems which are certain to be targeted for cuts.

D. RECOMMENDATIONS

In many ways 1984 is like 1974 for defense acquisition managers. Large spending cuts are being proposed, unit costs continue to climb, and the "catch-up" defense spending projections which may not have caught up anyway are now under revision, downward revision. The only recommendation for acquisition managers that seems appropriate in this environment is to carefully weigh the advantages and disadvantages of a high/low mix wherever possible in new system selection decisions. The highly sophisticated, costly systems are subject to stretched-out buys and wholesale cuts. An attractive package of low end alternatives in quantity and high cost complements in small numbers may be the only way a new force package can be accepted in Congress. The argument that a lower cost alternative threatens the integrity of the high end program it complements will dissolve in the realities of the growing deficit and reduced rate of increase in defense budgets.

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